

Tree and Brush Control  
- For -  
County Road Right-of-Way

Iowa Highway Research Board  
Iowa Department of Transportation

Roadside Management Program  
University of Northern Iowa

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Disclaimer: The opinions, findings, and conclusions expressed in this publication are those of the author and not necessarily those of the Iowa Department of Transportation.

## Abstract

This manual summarizes the roadside tree and brush control methods used by all of Iowa's 99 counties. It is based on interviews conducted in Spring 2002 with county engineers, roadside managers and others. The target audience of this manual is the novice county engineer or roadside manager. Iowa law is nearly silent on roadside tree and brush control, so individual counties have been left to decide on the level of control they want to achieve and maintain. Different solutions have been developed but the goal of every county remains the same: to provide safe roads for the traveling public. Counties in eastern and southern Iowa appear to face the greatest brush control challenge.

Most control efforts can be divided into two categories: mechanical and chemical. Mechanical control includes cutting tools and supporting equipment. A chain saw is the most widely used cutting tool. Tractor mounted boom mowers and brush cutters are used to prune miles of brush but have significant safety and aesthetic limitations and boom mowers are easily broken by inexperienced operators. The advent of tree shears and hydraulic thumbs offer unprecedented versatility. Bulldozers are often considered a method of last resort since they reduce large areas to bare ground. Any chipper that violently grabs brush should not be used.

Chemical control is the application of herbicide to different parts of a plant: foliar spray is applied to leaves; basal bark spray is applied to the tree trunk; a cut stump treatment is applied to the cambium ring of a cut surface. There is reluctance by many to apply herbicide into the air due to drift concerns. One-third of Iowa counties do not use foliar spray. By contrast, several accepted control methods are directed toward the ground. Freshly cut stumps should be treated to prevent resprouting. Basal bark spray is highly effective in sensitive areas such as near houses. Interest in chemical control is slowly increasing as herbicides and application methods are refined.

Fall burning, a third, distinctly separate technique is underused as a brush control method and can be effective if timed correctly.

In all, control methods tend to reflect agricultural patterns in a county. The use of chain saws and foliar sprays tends to increase in counties where row crops predominate, and boom mowing tends to increase in counties where grassland predominates.

For counties with light to moderate roadside brush, rotational maintenance is the key to effective control. The most comprehensive approach to control is to implement an integrated roadside vegetation management (IRVM) program. An IRVM program is usually directed by a Roadside Manager whose duties may be shared with another position. Funding for control programs comes from the Rural Services Basic portion of a county's budget. The average annual county brush control budget is about \$76,000. That figure is thought not to include shared expenses such as fuel and buildings. Start up costs for an IRVM program are less if an existing control program is converted. In addition, IRVM budgets from three different northeastern Iowa counties are offered for comparison in this manual.

The manual also includes a chapter on temporary traffic control in rural work zones, a summary of the Iowa Code as it relates to brush control, and rules on avoiding seasonal disturbance of the endangered Indiana bat. Appendices summarize survey and forest cover data, an equipment inventory, sample forms for record keeping, a sample brush control policy, a few legal opinions, a literature search, and a glossary.

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**For many Iowa counties, a typical problem:**

*“I’m very interested in coming up with an effective solution to brush control. We’ve been stymied. We’ve got 6,700 acres of ROW to manage. Probably two-thirds of that, 4,500 acres, are susceptible to trees and brush. We have 18 people and are pretty much limited to the road top. How many people will it take to maintain that 4500 acres?”*

– Tim Ehrich  
 Engineer  
 Wayne County

## SECTION 1 – INTRODUCTION

### 1.1 Defining the Objectives



(US Highway 20 Association)

Woodbury County.

Well maintained right of way west of Correctionville. Brush in this area is most dense along the Little Sioux River corridor.

- **Safety.** The primary goal of county roadside tree and brush control is to provide safe roads for the traveling public. Safety concerns and goals include:
  - **Sight lines.** Provide motorists unobstructed lines of sight.
  - **Recovery zone.** Eliminate immovable objects.
  - **Snow drift.** Alleviate substantial and chronic drifting of snow.
  - **Ice melt.** Reduce shade where it prolongs ice on the road.

Other roadside tree and brush control objectives:

- **Drainage.** Convey runoff from the road.
- **Efficiency.** Promote smooth flow of traffic.
- **Worker safety.** Deal with trees while they are small.
- **Aesthetics.** Balance safety and beauty
- **Land stewardship.** Protect soil and water.
- **Liability.** Reduce lawsuit exposure.
- **Public relations.** Talk to the people.

*“A major issue facing Iowa counties today is brush control. It has been ignored and is a growing problem.”*

– Michael Olson  
Engineer  
Jasper County

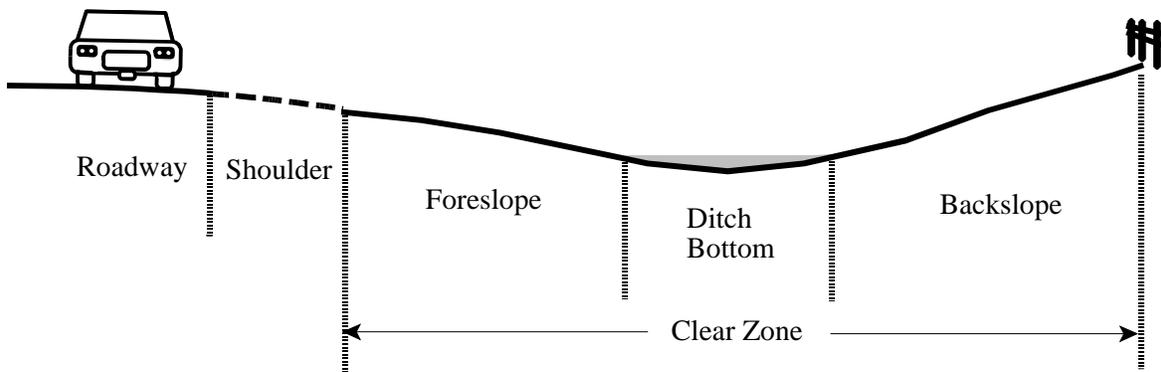
## 1.2 Determining the Level of Control

Iowa law is not specific when addressing the level of control a county must provide. Individual counties decide on the level of control to achieve and maintain. Determining factors include current degree of infestation, resources available and expectations of the population. Generally all counties provide for visibility at intersections, curves and drive ways. Counties must also maintain a clear zone.

The **Clear Zone** is defined as- An obstruction-free vehicle recovery area adjacent to the road traveled lane. It may consist of either:

- a shoulder, foreslope, ditch bottom and backslope.
- a shoulder, recoverable slope, non-recoverable slope, and/or a clear run-out area.

The desired width of the clear zone is dependent upon the traffic volume and speeds, and on the roadside geometry.



Shoulder, foreslope and ditch bottom are kept clear of immovable objects. Backslope maintenance is more subjective. Some counties adopt a zero tolerance rule and try to wipe out every tree from fence line to fence line. Others can't afford to. Many counties set up a rotation with the goal of working through the entire county in a stated period of time such as every five years. Priority is given to paved and high traffic roads. Public complaints are addressed as circumstances justify interrupting the maintenance rotation.

*“A lot of the brush problems begin at the fence row. Then one thing leads to another and the brush begins to encroach. I look at it as a community garden. It doesn't matter how clean I keep my garden, if my neighbor's garden is weed infested, its not long before it spills over into mine.”*

– Tim Ehrich, Engineer, Wayne County

### 1.3 Getting Started



(Josh Finley)

#### Cerro Gordo County.

This north central Iowa county lies within the Des Moines Lobe of the former Wisconsin glacier. Although only 3.6% of the county is forested, work crews still have a difficult time keeping up with advancing roadside trees and brush.

If you are a new engineer or roadside manager, here are steps we have found helpful when starting a brush control program.

#### Public Input

Some people want no trees. Some want them hanging all over. Gaining a consensus is not likely. Hold public forums to let people see the range of interests with which you deal and where the majority of people stand. Listening to the people keeps you in touch and helps relieve the public's sense that they have no control. If you are not good at such meetings, get help from someone who is.

#### Inventory

Besides paying for native seed, native grass drills, hydro-seeders and other native vegetation management equipment, The **Living Roadway Trust Fund**, administered by Iowa Department of Transportation, allows \$4500 for roadside inventories. A county can hire someone for 6 to 8 weeks to drive every road in the county and document roadside conditions. Stored on maps or computer, data include location of prairie remnants, weeds, trees, brush, erosion and encroachment. This tool helps prioritize work and measure progress. A second \$4500 is available if the survey was not completed.

#### Budget

It's not just a matter of being organized and sincere. A successful program takes money, buying equipment, paying wages. Counties most satisfied with their efforts are those committing the necessary resources. For a new program in a county with a lot of trees, figure three full-time employees, \$100,000.00 to \$150,000.00 startup costs for equipment and \$75,000.00 for annual operating expenses (fuel and labor not included). Support from the County Supervisors is imperative.

*“Settlement patterns in a county affect the way brush control is conducted.”*

– Harold Pollmeier  
Roadside Manager  
Henry County

## **Planning**

Ideally you'll have two plans, annual and long-range. The one-year plan includes specific items that need to be accomplished in order to be on track to meet the goals of the more general, overall plan. The plan will require assessing the current situation and deciding on the level of control to be achieved. Include measurable goals such as 'X' number of townships will be cleared the first year. The first few years may be more a matter of prioritizing a list of sites for crisis management. Get the plan approved by the engineer and the supervisors. Review it with them annually.

## **Equipment**

Two pickups, a truck or two, two tractors, spray equipment, boom mower, tree shear, back hoe, excavator, at least one chipper and a variety of chain saws. See the mechanical control methods section and the equipment lists in the appendix. You don't have to have it all. But integrating various techniques is good, year-round strategy. Make use of what you already own. Talk to other counties before you buy.

*"All parts of a roadside brush control program are integral. Take away one aspect and the program suffers."*

- Jeff Chase  
Roadside Manager  
Des Moines County

## **Personnel**

Get a good chain saw guy, one that can maintain equipment and train others. The county probably already has some good heavy equipment operators. Try to find seasonal help that will come back two or three years. It makes a huge difference if you can hire two full-time people. Use secondary road people when possible and conservation board people when appropriate. Knowledge of plant species and plant physiology is valuable.

## **Training**

Factory reps offer good training on operating and maintaining equipment, chain saw safety and working with chemicals. Send crews to conferences and workshops. Recommend topics to the people at UNI. Herbicide certification is offered through Extension and Weed Commissioners' Conference.

## **Public Education**

Stay in the habit of giving talks to interested groups. Send press releases to local papers. Remind the public of the effort being made. Instruct crews to recognize sensitive situations and when to talk to landowners before cutting. Role playing exercises might be helpful.

## **Management Techniques**

Foliar spray and boom mower are good for infestations of smaller trees and brush. Cut big trees as efficiently as possible. Heavy equipment can speed things up. Treat cut stumps. Employ basil bark treatment in sensitive areas. See the work calendar for seasonal operations. Spot spray regrowth. Watch for opportunities to conduct prescribed burns in native vegetation.

### 1.4 Calendar of Operations (What to do when?)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

#### Felling/Pruning a Tree

Lopper & Bow Saw	X	X	X	X	X	X	X	X	X	X	X	X
Weed Eater with Saw Blade	X	X	X	X	X	X	X	X	X	X	X	X
Chain Saw	X	X	sap rising		X	X	X	X	X	X	X	X
Excavator/Chain Saw: Score & Topple Trees	X	X	X	X	X	X	X	X	X	X	X	X
Pole Saw	X	X	X	X	X	X	X	X	X	X	X	X
Aerial Lift Truck/Chain Saw	X	X	X	X	X	X	X	X	X	X	X	X
Tree Shear	X	X	sap rising		X	X	X	X	X	X	X	X
Limb Lopper	X	X	X	X	X	X	X	X	X	X	X	X

#### After Cutting

Treat Cut Stumps with:												
<i>Tordon RTU or Pathway</i>	X	X	sap rising		X	X	X	X	X	X	X	X
<i>Pathfinder II</i>	X	X	X	X	X	X	X	X	X	X	X	X
Foliar spray sprouts growing from cut stumps with <i>Krenite</i>						X	X	X	X			
Chipper	X	X	X	X	X	X	X	X	X	X	X	X
Burn Freshly Cut Trees	X	X	X	X						X	X	X

#### Mowers and Brush Cutters

Rotary Grass Mower					X	X	X	X	X	X		
Boom Mower	X	X	X	X	X	X	X	X	X	X	X	X
Brush Cutter	X	X	X	X	X	X	X	X	X	X	X	X

#### Heavy Equipment

Clearing Frozen Plum Thickets	X	X	if froze n									if froze n
Grubbing Out By The Roots				X	X	X	X	X	X	X	X	
Bulldozing	X	X	X	X	X	X	X	X	X	X	X	X
Bulldozing with minimal disturbance	X	X	if froze n									if froze n
Mechanical Seeding			X	X	X	X	X	X	X	X	X	

Section 1 – Introduction

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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**Chemical Controls (except cut stump)**

<b>Basal Bark Spray</b> Triclopyr (Garlon 4, Pathfinder II)	X	X	X	X	X	X	X	X	X	X	X	X
<b>Foliar Spray</b>												
2,4-D Ester				X	X				X	X		
2,4-D Amine				X	X	X	X	X	X	X		
Dicamba (Banvel)				X	X				X	X		
Fosamine Ammonium (Krenite)							X	X	X	X		
Glyphosate (RoundUp)				X	X	X	X	X	X	X		
Imazapyr (Arsenal, Stalker)							X	X	X	X		
Metsulfuron-methyl (Escort)							X	X	X	X		
Picloram (Tordon)							X	X	X	X		
Triclopyr (Garlon, Pathfinder, Remedy, Crossbow)				X	X				X	X		

**Other Notes**

Prescribed Burning			X	X	X				X	X	X	
Indiana Bat Cutting Rules in Effect				X	X	X	X	X	X			

*“It sometimes depends on public input on how much an area is treated. Repeat complaints get more attention.”*

– Walt Wickham  
Roadside Manager  
Clinton County

*“In the summer, we don’t get a lot of brush cutting done because of all the other work required. Once the roads and signs are in good shape (usually about fall) then we’re cutting.”*

– Lee Bjerke  
Engineer  
Winneshiek County

## 1.5 A Short History of Iowa Roadside Brush Control.

- Along many stretches of Iowa’s county roads, the roadside right-of-way is overgrown with trees and brush.
- Controlling vegetation has become a full time seasonal operation for many counties.
  - Many snowplow crews spend much of the winter cutting trees.
  - The problem is most acute in northeast and southeast Iowa where work crews are struggling just to maintain existing levels of roadside maintenance.
- The clear zone must be kept obstacle free for the safety of the traveling public.
  - Research by the Federal Highway Administration finds that a four-inch diameter tree can abruptly stop a car traveling at 55 mph that has left the roadway.

How did so much brush come to dominate the roadsides of Iowa, the tallgrass prairie state? It is difficult to point to a single cause, but the effects of many smaller events are cumulative. Here is a short history of roadside brush control in Iowa



- 12,000 BC The tallgrass prairie: Not a home for trees.
  - Iowa was the heart of the North American tallgrass prairie.
  - This grass-forb ecosystem dominated upland areas of Iowa and was estimated to cover between 70-80% of the state.
  - Hot, dry summers and cold, harsh winters favored grasslands over forests.
  - Seasonal wildfires destroyed/suppressed the growth of most woody species while simultaneously maintaining prairies.
- Except for oaks, trees and brush more common to Eastern hardwood forests were restricted to river valleys and marshy lowland areas.
- 1000 B.C. Climate warming reaches maximum then becomes cooler and moister.
  - Eastern hardwood forests begin to push westward.
- 1834 Iowa opens for settlement.
  - Prairie restricted to pastures and field margins, wildfire suppressed.
  - Lowland tree and brush species now free to invade upland areas.
- Mid 1800's Most of Iowa’s timber logged for railroad ties, lumber, and firewood.

Tree encroachment very slow. Seed sources limited.

- 1873 Joseph F. Glidden of DeKalb, IL designs the first barbed wire in 1873.
- 1876 Alexander Graham Bell builds the first telephone line between Brantford and Paris, Ontario, a distance of 8 miles.

The strongest allies of trees in the invasion of upland Iowa are barbed wire fences, utility lines and forest birds. Unlike prairie birds which sing in flight, forest birds perch to sing. These forest birds often feed on the seed-bearing fruits of forest trees, carrying the seeds far from a parent tree and depositing them in droppings along fence lines and utility corridors. Hence from early on, roadways lined by fences and utility lines have been predisposed as corridors of forest expansion.



(Des Moines Register)

- 1915 Des Moines Register begins its campaign: Get Iowa Out Of the Mud, lobbying for a network of paved farm to market roads.
  - Iowa has less than 25 miles of paved roads.
  - The campaign lasts until 1942.

- 1915 Iowa Code adopts Chapter 317 on Weeds.
  - Landowners required to perform their own weed control along roadsides.
- 1935 Rural Electrification Administration established.
  - Fewer than 11 of every 100 farms in the U.S. have electric service.
- 1937 Iowa Code adopts §317.3 which creates the county position of Weed Commissioner.

Trees and brush were slowly but steadily advancing. Northeast and Southeast Iowa counties were most affected.

- 1942 Legislature adopts a state constitutional amendment in 1942 earmarking all motor fuel taxes for road work.
  - The new amendment helps create and maintain a state-wide network of farm to market hard surface roads.
- 1944 USDA researchers in Beltsville, MD announce discovery of the broadleaf herbicide 2,4-D.
  - The new herbicide quickly gains acceptance by farmers and is ultimately adopted by Weed Commissioners in Iowa.
- 1945 Iowa inaugurates the Road Clearing Fund (§317.19) into the Iowa Code.



(BoondocksNet.com)

- A rural property tax directed the county weed commissioners to control weeds and brush along roadsides by either the “hire of necessary equipment” or by “contracting with adjoining landowners.”
- Newly developed motorized machinery can be used for mowing and spraying.
- This tax was imposed until 1981.

Once a tree is established along a fence line, it begins to expand its influence. Branches shade out grass which could otherwise help consume the tree during a fire. A mature tree reproduces itself by seed production. Many species also reproduce vegetatively by sucker sprouting from roots.

Traffic on Iowa roadways quickly increases following World War II. Roadsides in many counties are well groomed.

- 1946 a logger in Oregon invents the first modern chain saw.
  - The chain teeth were patterned after the teeth of a timber beetle larva which could chew through wood at will, irregardless of the grain.
- 1966 Federal Endangered Species Act inaugurated.
  - The act has been updated several times with the largest revision in 1973.
  - In Iowa the summer range of the endangered Indiana bat mandates timber harvesting rules (including roadsides) for 28 southeastern Iowa counties between April 1 and September 30.
- late 1960's-early 1970's The environmental movement favorably predisposes many to trees along roadsides.
- 1980 The anti-government movement promotes the philosophy: less government equals better government. Shrinking budgets mean less money for brush control.
- 1981 Iowa inaugurates Home Rule.
  - This provides funding for county weed and brush control at the discretion of the County Board of Supervisors.
  - Brush control becomes the domain of many county road departments.
  - Seasonal snowplow crews pressed into service to cut brush during warm winters.



- Early to mid 1980's Up to 1/3 of Iowa's counties abandon herbicide spraying programs after a spate of successful lawsuits claiming herbicide drift damage to crops from roadside spraying programs.
- 1985 Integrated Roadside Vegetation Management (IRVM) adopted in Black Hawk County.
  - Ultimately adopted as §314.22 of the Iowa Code.
  - Today about 47 counties have IRVM programs.

- Mid 1980's
  - IRVM, lawsuits, and concerns for protecting prairie remnants cause most counties to abandon blanket spraying in favor of integrated techniques.
    - Tree saplings no longer killed or stunted by routine herbicide applications.
    - Today only one Iowa county still blanket sprays.



- Mid 1980's (continued)
  - Rural populations decline noticeably.
    - Many family farms declare bankruptcy.
    - Increasingly, country residents are retired farm couples.
  - County revenues decline with the sagging farm economy.
    - Rural tax bases shrink.
    - Funding priorities in many counties shift away from brush control to more pressing issues.

Many county work crews are weather dependent. If several bad snow years fall consecutively the workforce is preoccupied with snow removal. During these times roadside woodlands are free to expand.

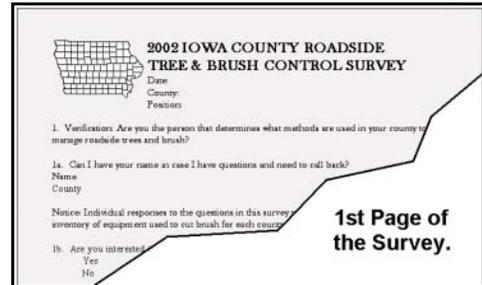
It takes only a few years for many Iowa tree species to produce a canopy that extends out from a ditch bottom or fence line to block a roadway.

- 1990's
  - Economic boom times do not translate into more money for brush control.
  - Herbicide costs steadily increase.
  - A seasonal fall foliage tourist industry develops in heavily wooded sections of eastern and southern Iowa.
  - Increased OSHA safety requirements for herbicide applicators translate to more expensive training programs for applicator certification.
  - Years of well publicized health studies prompt increasing numbers of employees and managers to balk at roadside herbicide application.
  - Urban sprawl and new divided highways allow affluent suburbanites to move to the country and still commute to work in town.
    - Many of these people are pro-trees, anti-herbicide, and anti-cutting.
  - Loss of the family farm means tree seedlings are no longer pressured by private weed control, haying, and grazing activities.
    - Remaining farmers are too busy trying to make ends meet to concern themselves with roadside brush along their field margins.
    - There is an increasing attitude among many rural residents that control of roadside brush is the government's job.
    - Increasing numbers of absentee and corporate landowners translate to many farmers who rent farmland rather than own.
      - There is a corresponding loss of pride in ownership.



(Iowa Tourism Office)

- Farm equipment has steadily increased in size.
  - Today’s machinery is often too big to use for mowing or haying roadside ditches.
- Removal of livestock from farms has produced a corresponding decline of ditch grazing by livestock.
- 2002 Iowa county roadside tree & brush control survey.
  - All 99 Iowa counties participate.



## References

- [Blount] Blount-Oregon Cutting Systems. 2002. Oregon company history. In: Oregon cutting systems. <<http://www.oregonchain.com/company/history.htm>>. Accessed 2002 Jun 24.
- Burnside OC. 1996. The history of 2,4-d and its impact on development of the discipline of weed science in the United States. In: USDA/NAPIAP: biologic and economic assessment of the benefits from use of phenoxy herbicides in the United States. Report nr 1-PA-96. ch 2.
- Des Moines Register. 2002. Get the mud out. In: Des Moines Register headlines: news extras: sesquicentennial. <<http://desmoinesregister.com/extras/sq/editorials2.html>>. Accessed 2002 Jun 14.
- [FHA] United States Department of Transportation/Federal Highway Administration. 1986. Roadside improvements for local roads and streets [Pamphlet].
- The world book encyclopedia. 20 volumes. Chicago: Field Enterprises; 1965.
- Holland S, webmaster. 2002. Integrated roadside vegetation management. In: Iowa Living Roadway Trust Fund. Ames, IA: Iowa Department of Transportation, Office of Design. <<http://www.iowalivingroadway.com/irvm.asp>>. Accessed 2000 Jul 17.
- Howell D. 2002. [Memo to Iowa Counties from the Iowa Department of Natural Resources]. Guidelines for protection of Indiana bat summer habitat.
- Iowa Code §140 (1945) [Act creating §317.19 ]
- Iowa Code §317.19 (1946) [First code containing §317.19]
- Iowa Code §117 (1981) [Home Rule implemented]
- Iowa Code §317.19 (1981) [The last year of §317.19]
- Iowa Code §317.19 Sec. 123-24 (1983) [Act that replaces §317.19]
- Iowa Code ANN. §317.19 (West 2001) [As it appears today]
- Packard S, Mutel CF, editors. 1997. In: The tallgrass restoration handbook: for prairies, savannas, and woodlands. Washington: Island Pr. p xii-xvii.
- [USFWS] U.S. Fish and Wildlife Service. 2002. History and evolution of the endangered species act of 1973. In: USFWS: conserving the nature of America. <<http://endangered.fws.gov/esasum.html>>. Accessed 2002 Jul 17.

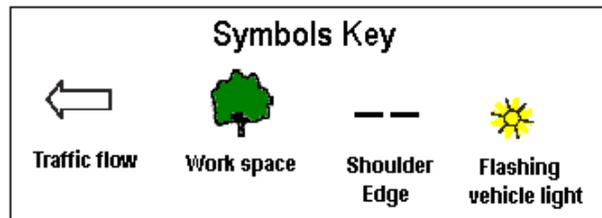
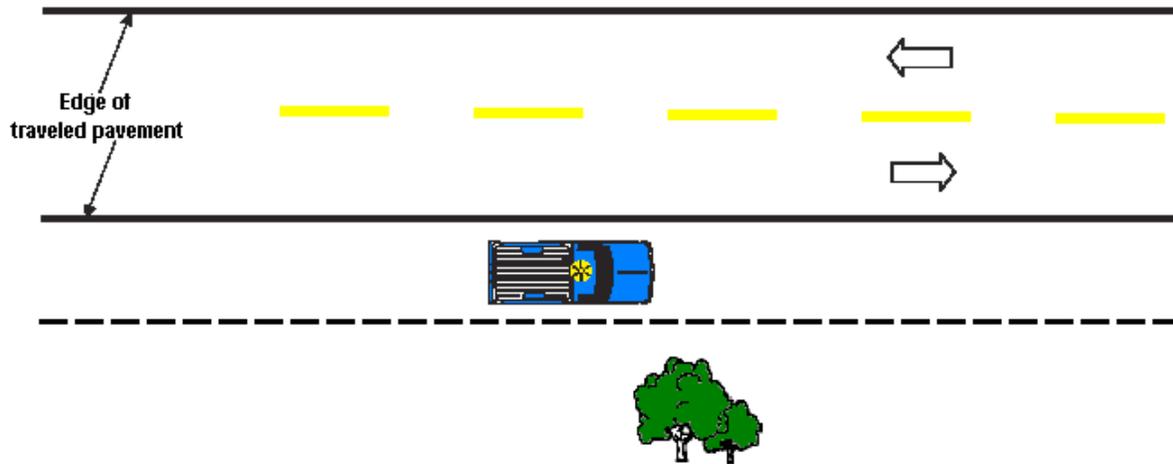
## SECTION 2 – TRAFFIC CONTROL IN WORK ZONES



- It is not surprising that when maintenance vehicles encroach on a roadway, the normal traffic flow of that roadway is impaired.
  - But even working alongside a roadway creates the potential to distract a motorist, so work crews and their equipment should always be considered potential roadway hazards.
  - Because of this, roadside brush control managers must provide for temporary traffic control that safely routes traffic around temporary work zones.
  - Temporary traffic control solutions must be applied with common sense to fit each situation, and may need to evolve over time as conditions change.
- All work zones have 4 components:
    - An advance warning area
      - Tells traffic what to expect ahead.
    - Transition area.
      - Moves traffic out of its normal path.
    - Activity area.
      - A buffer space provides protection for traffic and workers.
      - Contains the actual work area.
    - Termination area.
      - Lets traffic resume normal driving.
  - Roadside tree brush control is usually a slowly moving work zone performed in daylight hours. Any work site lasts only as long as the particular brush problem, but the duration of work varies considerably.
    - For example the operator of a road grater may stop for a break and cut a single offending tree with loppers.
    - By contrast, a work crew may spend a week removing large trees and brush from a single stretch of heavily overgrown roadside section.
  - Levels of temporary traffic control should reflect the most hazardous aspect of an operation.
    - For example a crew removing brush with chain saws is often involves a chipper or supply truck parked on the shoulder.
    - There may even be temporary roadway encroachment as crews wrestle brush into the chipper.
    - Tractors and excavators that support boom mowers, brush cutters, and tree shears may operate within the traveled way and block an entire lane of traffic while reaching out 30 ft into the clear zone.
  - Work zone guidelines established by the Federal Highway Administration rules can be difficult to interpret for smaller roadside brush control jobs.
  - Most brush clearing projects can follow these 5 sample applications that follow.
  - For more complex projects, consult the MUTCD 2000 or other traffic control reference.

### 2.1 Short term roadside work with no encroachment on the roadway.

- For workers and equipment operating within 15 feet of the edge of the traveled way for up to 1 hour.
  - If work lasts more than one hour, go to Figure 3-2.
- The vehicle shall be parked on the shoulder as far from the open traffic lane as possible.
  - Whenever appropriate, entrances and driveways should be used.
- Vehicle shall be equipped with a yellow revolving light or yellow strobe light.

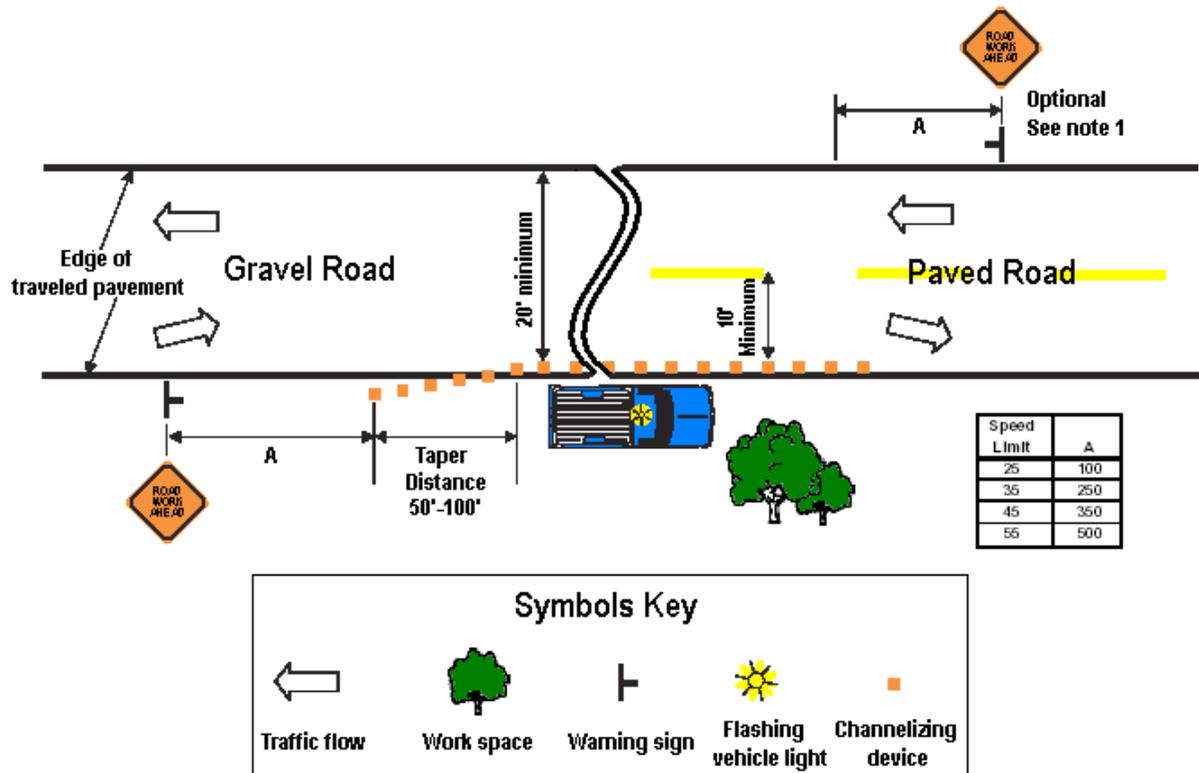


## 2.2 Minor encroachment of a work zone onto a 2-lane road.

- Applies to either gravel or paved roads.
- If working longer than 1 hour and no encroachment, cones not needed.
- Sign required in opposite traffic lane only when sight distance is restricted.
- Flagger protection not required, provided bi-directional traffic can move freely at reduced speed through the work space.

### Applications

- Chain saw crews, cut stump treatments, chipper.
- Foliar spraying.
- Basal bark spraying.

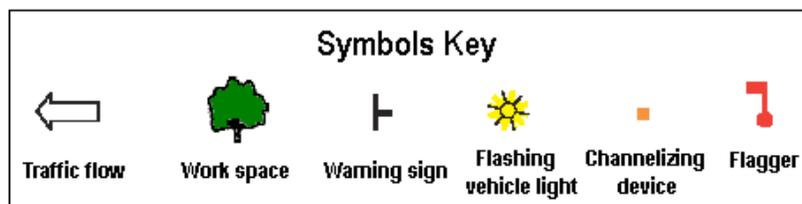
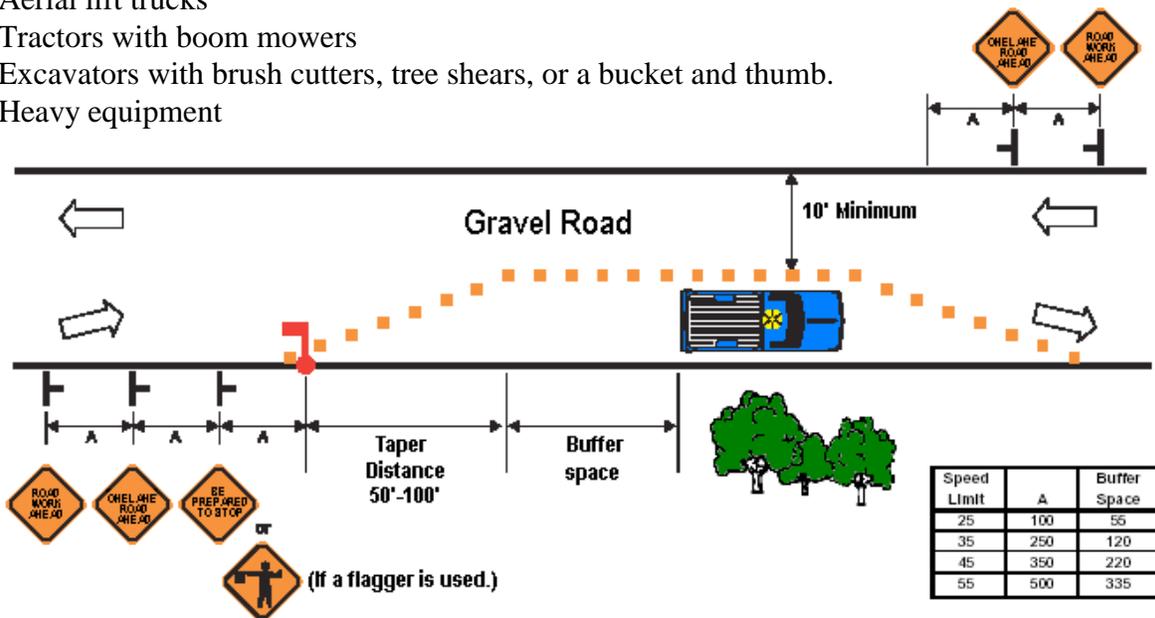


### 2.3 Major encroachment/lane closure on a gravel road. Traffic is self regulating.

- Diagram lane closure during daylight hours.
- Traffic volume must be less than 2,000 vehicles per day.
- No parking for work vehicles on opposite shoulder within 500 feet of work area.
- Traffic in the open lane shall be allowed to flow freely.
- Cone spacing will vary with speed.
- A flagger shall be required if
  - visibility is less than 1/4-mile
  - potential traffic conflict exists.
  - traffic flow is more than 15 vehicles in 15 minutes.
- A two-foot safety zone is required between the cones and the truck when access to the truck is necessary and the side is exposed to traffic.
- Remaining lane should be at least 10 feet wide or the lane should be closed.
  - However 9 feet is acceptable for short-term use if traffic is
    - low-volume
    - low-speed
    - does not include long, heavy commercial vehicles.

#### Applications

- Aerial lift trucks
- Tractors with boom mowers
- Excavators with brush cutters, tree shears, or a bucket and thumb.
- Heavy equipment

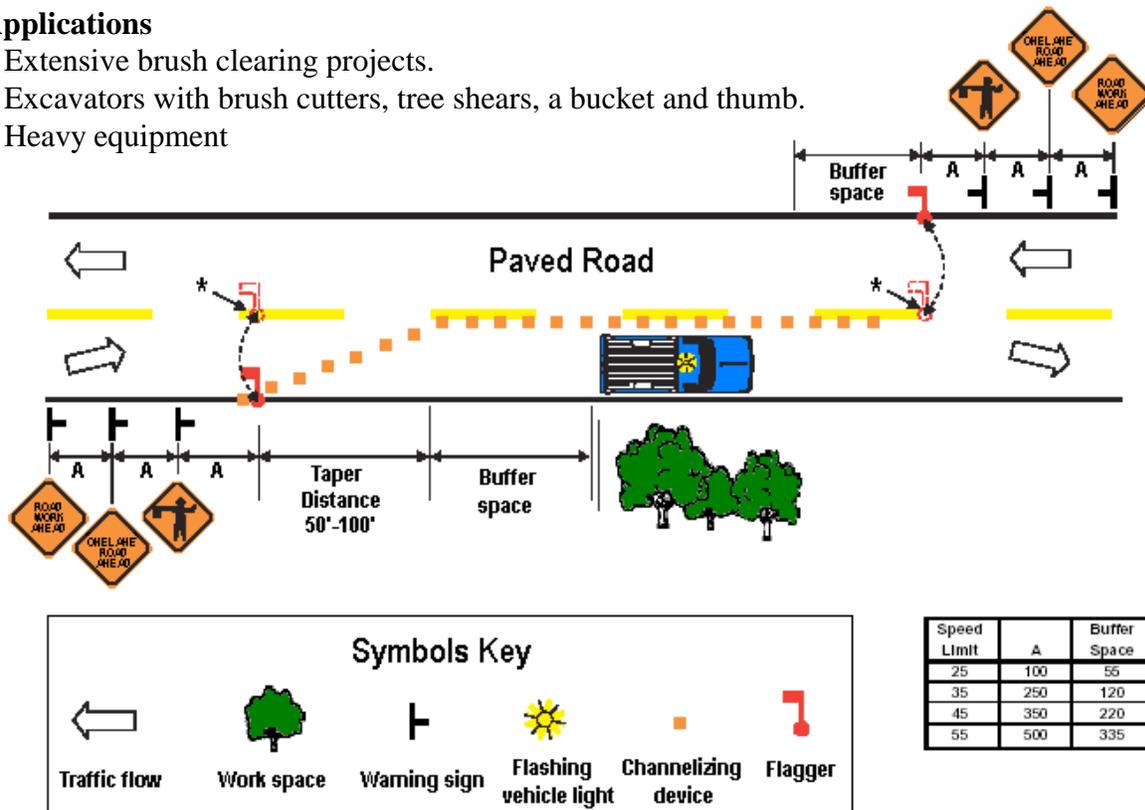


## 2.4 One lane closed of a 2-lane road. Closure less than 1/4 mile long.

- For work during daylight hours only.
- No parking for work vehicles on opposite shoulder within 500 feet of work area.
- Cones
  - Spacing of cones in a taper should be 10 to 20 feet.
  - A minimum of five devices are to be used in a taper.
  - Spacing of cones through a work space
    - 20 feet where horizontal curve radius is less than 300 feet.
    - 50 feet where horizontal curve radius is from 300 feet to 1,000 feet.
    - 120 feet for all other cases.
  - Individual cones may be omitted during work hours in areas where placement interferes with the work. Cones in taper required at all times.
- Flagger
  - The flagger shall stop the first vehicle from the position shown, then cross traffic lane to stop other vehicles.
  - Additional flaggers shall be stationed at intersections or crossings within the work space to prevent vehicles from entering against the flow of traffic.
  - The length of the work area may change as much as 1/2 mile, for a short time, to improve the flagger's sight distance.

### Applications

- Extensive brush clearing projects.
- Excavators with brush cutters, tree shears, a bucket and thumb.
- Heavy equipment



**References**

- IA DOT. 2000. Iowa work zone safety guidelines for utilities, rev June 2000.  
<[http://www.dot.state.ia.us/pdf\\_files/work\\_zone\\_utilities.pdf](http://www.dot.state.ia.us/pdf_files/work_zone_utilities.pdf)>. Accessed 2002 Jul 2.
- IA DOT Office of Design. 2002. Standard road plans, RS series traffic control.  
<<http://www.dot.state.ia.us/design/stdplnrs.htm>>. Accessed 2002 Jul 2.
- FHWA. 2001. Part six, work zones. In: MUTCD 2000: manual on uniform traffic control devices. Millennium ed. With incorporated revision number 1 changes, dated December 28, 2001. <[http://mutcd.fhwa.dot.gov/kno-millennium\\_12.28.01.htm](http://mutcd.fhwa.dot.gov/kno-millennium_12.28.01.htm)>. Accessed 2002 Jul 2.

## SECTION 3 – MECHANICAL BRUSH CONTROL

### 3.1 Mechanical Brush Control



(Chris Snyder)

Mahaska County.

*“We notch trees with a chain saw, then put the backhoe against the tree and give it a shove in the direction we want it to fall. This is very safe & efficient. Finally the tree is picked up by the backhoe, placed on the road, and pushed to the burn pile.”*

–Chris Snyder, Roadside Manager, Mahaska County

- In Iowa there are three approaches used for the mechanical removal of roadside brush.
  - Cutting the plant at ground level.
    - Hand cutting.
    - String trimmers & Brush blades.
    - Chain saws.
    - Tree shears.
    - Excavator thumbs.
    - Rotary grass mowers.
  - Overhead cutting.
    - Pole saws.
    - Aerial lift trucks.
    - Boom mowers.
    - Brush cutters.
    - The limb lobber
  - Removing a plant by its roots.
    - Grubbing
    - Recontouring with heavy equipment
    - Mechanical seeding.
- *Appendix B* contains a list of equipment by county.
  - Boom mowers and supporting tractors.
  - Brush cutters and supporting excavators.
  - Tree shears and supporting excavators.
  - Excavator thumbs and supporting excavators.
  - Rotary grass mowers (used for brush control) and supporting tractors.
  - Equipment used to grub out trees.

### 3.2 Safety and Mechanical Brush Control



(OSHA 2002)

The Internet web address for the United States Office of Occupational Safety and Health Administration (OSHA) homepage is <<http://osha.gov/>>.

- All employees should have adequate training in the proper use of the equipment they are assigned to operate.
- Check with supervisor on any items of uncertainty.
- Bystanders should be kept away from a work site.
- All personal protective equipment (PPE) should be kept clean and useable.
- An OSHA approved first aid kit should always be available on the job site.
- All employees are encouraged to become certified in First Aid and CPR. Keep training up to date by taking refresher courses as needed.

All other safety data is reference by method.

#### **Important**

Safety comes before any other aspect of the job since operator accidents can result in severe injury or death.

## CUTTING THE PLANT AT GROUND LEVEL

### 3.3 Hand Cutting



Loppers

(Trail Center 2002)



Bow Saw

(Pacific Harvest 2002)

#### Application

- Used to cut or trim small trees and tree branches.
- Inexpensive, fast and convenient.
- Lowest level maintenance for effective brush control.
- Good exercise for road-weary drivers.

#### Safety

- All tools must be used only for the purposes for which they are designed.
- All hand tools must be in serviceable condition and be stored in their assigned location or container when not in use.
- When transporting tools in a vehicle, they must be secured or arranged to prevent causing a hazard to the vehicle driver and passengers.

#### Issues

- Stump treating any cut stump would improve efficiency.

#### Iowa Summary

- 5 counties report using hand pruning as a method of brush control.\*
- It comprises about 25% of their brush control effort.

\*Casual data, use is probably more widespread.

*“Hand cutting brush gives the heavy equipment operators exercise, relieves the monotony and helps us keep up with brush.”*

– Paul Jacobson  
Engineer  
Humboldt County

### 3.4 String Trimmers & Brush Blades



(Ryobi 2002)

A string trimmer equipped with a brush blade is sometimes used to cut light brush. Pictured here is a Ryobi 890R 4-Cycle Straight Shaft TrimmerPlus-Brushcutter.

#### Application

- String trimmers equipped with brush blades are used in 33 of Iowa’s counties to control light brush.
- These are most commonly used to control twiggy brush such as willows or small red cedars.
- Application is usually near the road shoulder where it is used to trim brush away from signs, guard rails, and bridges.
- This equipment can be integrated with foliar spray, and used to cut down standing dead vegetation.

#### Issues

- Many who do not use string trimmers with brush blades consider them better suited for weed control rather than brush control.

#### Safety

- Wear all personal protective equipment (PPE) as required by state and OSHA regulations:
  - Hard hat with ear and face protection
  - Saw chaps
  - Cut-resistant boots
- Inspect string trimmers before use.
- Insure that all required safety features are in place and working properly.
- Insure that fuel is mixed correctly and in OSHA approved, labeled containers.
- Do not fuel a string trimmer within 10 feet of open fire.
- Do not start a string trimmer within 10 feet of the fueling point.
- Obtain firm footing before starting a string trimmer.
- Insure the string trimmer is adjusted and operated according to manufacturers instructions
- Never work alone
- Despite all precautions “kickback” can occur while using a brush blade.
- In steep or uneven terrain, operators can slip or stumble while using string trimmers.
- Operators fatigue after only a few hours of work after which the risk of accident increases.

#### Iowa Summary

- 33 counties use string trimmers equipped with brush blades.
- String trimmer cutting comprises a very small percentage of their brush control effort.
- Few brand names were mentioned.

### 3.5 Chain Saws



(Blake Deilber)

Crawford County.

County employee Marc Gosch cutting hazard trees from the clear zone.



(Stihl)

Chain saws are used statewide to remove unwanted trees and brush from roadsides. Pictured here is a Stihl 021 saw.

#### Application

- Chain saws are used in every Iowa county to control roadside trees and brush.
- They are versatile and come in a range of sizes and prices.
- Chain saws can be used for almost any job a hand saw could be considered for.
- Chain saws are commonly used to fell trees, prune branches and section logs into convenient lengths.
- It is standard practice to carry a repair kit for minor repairs and fresh cutting chains.

#### Issues

- Stumps should be cut within 3-4" of the ground.
- Winter cutting in ditches full of snow can leave tall stumps that remain as a clear zone hazard.
- Branches should be pruned in accordance with recommended ANSI arboriculture practices.
- Cutting chains wear quickly and county crews often make and sharpen their own chains.
- Standardize guide bar lengths on saws so that chains are interchangeable between saws.
- It is often cheaper to purchase a new saw than to repair an old one. If your county has trees to cut on a regular basis, budget for replacement saws.
- Cut limbs and stumps often produce multiple sprouts. Stump treating after cutting can help reduce this problem.

#### Safety

- Wear all personal protective equipment (PPE) as required by state and OSHA regulations:
  - Hard hat with ear and face protection
  - Saw chaps
  - Cut-resistant boots
- Inspect chain saws before use.
- Insure that all required safety features are in place and working properly.
- Insure that fuel is mixed correctly and in OSHA approved, labeled containers.

#### Did You Know?

The risk of personal injury and high cost of labor and insurance is making chain saws less and less appealing as an option for tree and brush control.

- Do not fuel a saw within 10 feet of open fire.
- Do not start a saw within 10 feet of the fueling point.
- Obtain firm footing before starting a chain saw.
- Insure the saw is adjusted and operated according to manufacturers instructions
- Never work alone
- Engage chain break when not cutting or when carrying the saw.
- Look for hazards before starting to fell trees and clear them before cutting.
  - dead limbs
  - vines
  - lean of tree
  - location of other trees
  - slope of ground
  - visible defects or inclusions
    - wire fences
    - steel posts
  - excessive ground cover/brush
- Try not to fell trees onto the roadway.
- Stay two tree-lengths distance from other workers.
- Always plan and have a retreat path.
- Despite all precautions “kickback” can occur while using a chain saw.
- Flag lodged or danger trees.
- In steep or uneven terrain, operators can slip or stumble while using chain saws.
- Operators fatigue after only a few hours of work after which the risk of accident increases.

*“I consider chain saws a 1-year disposable item. Its actually cheaper to buy a new saw than do maintenance on it.”*

– Charles Marker  
Engineer  
Cass County

*“We have a variety of chain saws. Most are medium-sized saws with 16 to 20 inch guide bars. We also have Big Bertha – it has a 36 inch guide bar.”*

– Jake Ford  
Roadside Manager  
Adair County

### **Iowa Summary**

- 99 Counties use an unknown number of chain saws.
- Chain saw cutting comprises about 47% of their brush control effort.
- The most common chain saw:
  - manufacturer: Stihl
  - model: 026
  - guide bar length: 16 - 20"
- Overall Satisfaction (Low) 1..2..3..4..5..6 (High)
  - average: 4.2
  - Satisfaction with mechanical results (almost always excellent) was consistently tempered by the high cost of labor and insurance.
- Typical saw compliment:
  - two 12-15" bar saws
  - two 16-20" bar saws
  - one 21-24" bar saw
  - one 30" bar saw

**Purchasing**

- Businesses listed are for the chain saw table in Appendix B.
- Ranked in descending order of manufacturer popularity.

Stihl Incorporated  
536 Viking Drive  
Virginia Beach, VA 23452  
800 467-8445

Homelite Service Center  
800 242-46  
chain saws from any Home Depot store

Husqvarna Forest & Garden Co.  
9006 Perimeter Woods Drive  
Charlotte, NC 28216  
704 597-5000

Echo Incorporated  
400 Oakwood Road  
Lake Zurich, Illinois 60047  
800 673-1558

John Deere Commercial and Consumer  
Division  
2000 John Deere Run  
Cary, NC 27513  
800 537-8233

Poulan Customer Service  
Electrolux Home Products  
1 Poulan Drive  
Nashville, AR. 71852  
800 554-6723

Shindaiwa Inc.  
11975 SW Herman Road  
Tualatin, Oregon 97062  
503 692-3070

Jonsered USA  
Tilton Equipment Company  
P.O. Box 68  
Rye, New Hampshire 03870  
877 693-7729

McCulloch Corporation  
4001 South Contractor Way  
Suite 121  
Tucson, Arizona 85714  
800 521-8559

### 3.6 Tree Shears



A.



B.

(Kris Katzman)

Taylor County.

A. A New Dymax 18" Forestry Tree Shear supported by a Caterpillar 320B L track excavator.

B. Cutting head detail.

#### Application

- Used to cut trees off at the base.
- Mounts on the arm of a wheel or track excavator.
- A single operator can clear many miles of road in a day.
- Neatly chops and stacks branches or whole trunks into manageable lengths.

#### Issues

- Quick and efficient.
- Jaw ratings from the factory are optimistic.
  - For example, operator of a 14" jaw shear says you're better off staying at 10 inches and under.
- Cut limbs and stumps often produce multiple sprouts.
  - Stump treating after cutting can help reduce this problem.
- Ability to avoid leaving stumps is limited by excavator reach.
- Wheeled excavators are restricted to roadways, while track excavators can be driven down into the ditch.
- Wheel excavator arms need to extend outwards 30 feet to reach the edge of the clear zone.
- Tree shears can also be attached to skid steers.

#### Safety

- Equipment set up must include a variable speed foot peg on the excavator that allows for a gently controlled shear operation both forwards and backwards.
  - An automated, one-button cutting process has proven unsafe since it can accidentally topple a tree onto the operator or bystanders.
- Reduces operator injury.
  - Average chain saw operator back injuries in one county dropped from an average of 4 accidents/year to none.

### Iowa Summary

- 4 counties own a total of 5 tree shears.
- It comprises about 13% of their brush control effort.
- Most common tree shear:
  - New Dymax 18" Forestry Tree Shears
    - average jaw diameter 18"
    - equipped with a grapple
    - without an accumulator
- Most common supporting excavator:
  - Caterpillar 320B L Track Excavator
    - average reach 35'

*“Acquiring a tree shear reduced a crew of 8 people who were able to cut ¼ mile of roadside brush in 1 week to a crew of 5 people who could perform the same work in 1 day.”*

– Kris Katzmann  
Engineer  
Taylor County

### Purchasing

- Businesses listed are for the tree shear table in Appendix B.

Gregory (Roanoke)  
P O Box 269  
506 Oak Drive  
Lewiston-Woodville, NC 27849  
252 348-2531

Weldco-Beales  
1850 Marine View Drive  
Tacoma, WA 98422  
800 547-6357

### 3.7 Excavator Thumbs



(Greg Schmitt)

Buchanan County.  
A manual thumb mounted opposite the bucket of a John Deere 200C LC track excavator greatly increases the excavator's capabilities.

#### Application

- This device turns an excavator bucket into a clamshell pincer.
- Available in 2 forms:
  - Fixed (3 or 4 stops that can be adjusted manually to change the thumb angle)
  - Hydraulic (opens and closes remotely with a pincer motion that increases usefulness)
- There are 3 reported uses for excavator thumbs in Iowa roadside brush control:
  - Clamshell action is used to grab a tree and pull it up by its roots.
    - The tree is permanently removed.
    - Unfortunately this also disturbs the soil, damages conservative rootstocks, and may result in a weed bloom.
  - Excavator bucket is used to fell a chain saw scored tree.
    - This conserves the prairie under story.
    - Stump is chemically treated.
  - Clamshell action is used to carry whole trees and stack logs.
- A single operator can clean up many miles of road in a day.

#### Issues

- The fixed thumb can be damaged by the bucket if used at the wrong angle.
- Special design: Clayton County had Wag Way Bird Eye custom build a combination brush cutter (model 1000)/hydraulic thumb that fits as one head on their excavator. They are satisfied with the results.

#### Iowa Summary

- 6 counties own a total of 8 excavator thumbs.
- Most common thumb: both manual and hydraulic thumbs are popular.
  - Most common manufacturer: FLCO, New Dymax
- Most common supporting excavator: various models
  - Average reach 34.3 ft.

#### Did You Know?

Excavator thumbs retail for only a few thousand dollars and can greatly improve the efficiency of the already versatile \$150-200k excavator.

**Purchasing**

- Businesses listed are for the excavator thumb table in Appendix B.

Empire Bucket  
1316 Livingstone Rd  
Hudson, WI 54016  
800 242-2930

Pemberton Inc.  
P.O. Box 521000  
Longwood Florida 32752  
407 831-6688

New Dymax  
P.O. Box 368  
402 Miller Dr.  
Wamego, KS 66547  
800 530-5407

Wag Way Tool Company  
Bird Eye Division  
483 N. Mount Zion Rd.  
Vincennes, IN 47591  
800 992-4929

### 3.8 Rotary Grass Mowers



A.

(Tiger 2002)



B.

(Alamo 2002)

- A. Tiger twin rotary mower.
- B. Alamo flex-wing rotary mower.

- Tractor mounted grass mowers can be effectively used to control light brush in areas where ditches are dry and have accessible slopes of 2:1 or less.

#### Applications

- Clear zones are commonly mowed once or twice a season, usually in mid summer and after fall harvest.
  - Foreslopes.
    - Paved roads: regularly mowed.
    - Gravel roads: seasonally mowed.
      - Steep foreslopes often limit mowers to working from the roadway.
  - Ditch bottoms are seasonally mowed.
  - Backslopes: seasonal mowing, but access is often limited by woody vegetation.
- Rotary grass mowers can be integrated with other plant control methods.
  - Noxious weed control.
  - Foliar spray.
    - One county follows up ditch mowing after 1-2 years with foliar spray to catch woody regrowth.
    - Another county uses mowers to clear standing dead vegetation killed by foliar sprayed.
  - Brush clearing projects.
    - Once cleared of heavy brush and trees, the clear zone can be maintained by seasonal mowing if geometrics permit access.
  - Heavy equipment.
    - If an area is to be maintained by mowing, ditch slopes must safely accommodate the mower.
      - Slopes of 3:1 or less are recommended.
    - Once the clear zone has been recontoured, landowners often begin mowing their property.
  - Rotational Maintenance.
    - Crews can mow the roadsides of an entire county in a single year if clear zone geometrics have been planned to accept a mower.

*“In our county we have a motto: The land drains well and the brush grows well. Typically if you don’t mow every other year, you’ll have a good stand of brush.”*

– John Goode  
Engineer  
Monroe County

- Conservation management.
  - Set the mower height to leave 6-8 inches of standing vegetation.
    - In prairie remnants, this provides control of woody invaders without cutting off the growing points for forbs.
  - If mowing in summer, mow after the second week of July
    - This allows grass nesting birds to rear and fledge their chicks.
  - If mowing in fall, mow after the first week of November.
    - Late mowing allows warm season prairie plants time to produce and distribute seeds.
  - Integrate mowing with prescribed burning.
- Advantages of mowing.
  - Cuts a lot of brush quickly
    - Many mowers can easily cut saplings having stems several inches in diameter.
  - Cost effective.
  - Roadway aesthetics improved.
  - Sight distances, especially around intersections extended.
  - Animal habitat pushed back from the roadway.
  - Snow traps reduced.

#### Issues

- Mowing of roadsides by landowners.
  - Many comment that this helps control a significant amount of brush.
  - A few counties encourage landowners to hay their ditches if slopes permit.
  - Several engineers worry that landowners mowing ditches leads to debris that interferes with drainage.

*“We figure mowers are like Schick disposable razors—they don’t cost much and after a couple seasons in the roadside ditches, they’re beat up.”*

– Tim Ehrich  
Engineer  
Wayne County

#### Safety (Bean 1991)

- Wear OSHA approved hearing protection.
- Keep bystanders away from the work area since debris can be thrown some distance.
- Be alert to obstacles such as ditches, holes, rocks and stumps which can overturn a tractor.
  - Be especially alert when working in tall vegetation or brush.
- Use the seat belt if your tractor is equipped with roll-over protection.
- Before dismounting, disengage the power take-off (PTO), turn off the engine and set the brakes.
- Be sure the blades are stopped before approaching the mower.
- Be careful turning sharp corners.
  - On pull-type mowers, the rear tractor wheel can catch the mower frame and throw it up on the operator.
  - With three-point-hitch-mounted mowers, the mower can swing outward
- Set rear tires as wide as possible, since wide-set tires provide greater tractor stability and lessen the chance of a tractor overturn.

*“Our crews are always on the lookout for appliances that are tossed in the ditch. It’s very hard on the mowers to hit tires, microwaves, etc. Preventive maintenance is the trick. We pick up a lot of tires.”*

– Michael Saltzgaver  
Roadside Manager  
Lee County

### **Iowa Summary**

- 18 counties use rotary grass mowers for brush control.
- It comprises about 13.5% of their brush control effort.
- Another 6 counties remark that private landowners begin regular mowing after heavy equipment is used to flatten ditches.
- Twin mowers are most popular configuration (a side mount mower & rear mount mower on one tractor).
  - Typical side mower:
    - Tiger TM-60C
      - Average deck width: 67 inches
  - Typical pull-behind mower either:
    - Tiger TRR-60C rear
      - Average deck width: 68 inches
    - Alamo Hydro 15 Flexwing
      - Average deck width: 178 inches
  - Typical supporting tractor:
    - John Deere 6400
      - Average PTO horsepower rating: 84.1
      - Does not have MFWD

### **Purchasing**

- Businesses listed are for the rotary grass mower table in Appendix B.

Alamo Industrial  
1502 East Walnut  
Seguin, TX 78155  
800 882-5762

Schulte  
P.O. Box 70  
Englefeld, SK  
SOK 1NO Canada  
306 287-3715

Bush Hog, L.L.C.  
P.O. Box 1039  
Selma, Alabama 36701  
334 874-2700

Tiger Corporation  
3301 North Louise Avenue  
Sioux Falls, SD 57107  
800 843-6849

John Deere Commercial and Consumer  
Division  
2000 John Deere Run  
Cary, NC 27513  
800 537-8233

### **References**

Bean TL. 1991. Rotary agricultural mower safety. In: National ag safety database. Columbus, OH: Agricultural Engineering Department, Ohio State University Extension, Ohio State University. Publication nr AEX-592. <<http://www.cdc.gov/hydromulch/docs/d000101-d000200/d000136/d000136.html>>. Accessed 2002 Aug 15.

## OVERHEAD CUTTING

### 3.9 Telescopic Pruning Saws or Pole Saws



(Stihl)

A telescopic pruning saw by Stihl.

*“There is a tendency to cut the whole tree down when often times pruning would be sufficient.”*

– Walt Wickham  
Roadside Manager  
Clinton County

#### Applications

- The telescopic pruning saw allows higher branches to be cut while the operator is standing on the ground.
- Telescoping poles are available in several lengths from different companies.
- A backpack machine is also available for work in difficult terrain.

#### Issues

- Branches should be pruned according to ANSI standards.
- Standardize guide bar lengths on saws so that chains are interchangeable between saws.
- Cut limbs often produce multiple sprouts. Stump treating after cutting can help reduce this problem.

#### Safety

- Wear all personal protective equipment (PPE) as required by state and OSHA regulations:
  - Hard hat with ear and face protection
  - Saw chaps
  - Cut-resistant boots
  - *Optional but suggested:* Protective (cut-resistant) shirts
- Inspect pole saws before use.
- Insure that all required safety features are in place and working properly.
- Insure that fuel is mixed correctly and in OSHA approved, labeled containers.
- Do not fuel a saw within 10 feet of open fire.
- Do not start a saw within 10 feet of the fueling point.
- Obtain firm footing before starting a pole saw.
- Insure the saw is adjusted and operated according to manufacturers instructions
- Never work alone
- Engage chain break when not cutting or when carrying the saw.

- **Electrocution Hazard**
  - Approaching or contacting electric power lines may cause serious injury or death from electrocution.
  - Electricity can jump from one point to another by means of arcing and/or may be conducted through damp branches.
  - Maintain a clearance of at least 50 feet (15 meters) between the tools and any electrical line carrying a live current.
- Look for hazards before starting to cut branches and clear them before cutting.
  - dead limbs
  - vines
  - lean of branch
  - location of other trees and branches
  - slope of ground
  - visible defects or inclusions
    - wire fences
    - steel posts
  - excessive ground cover/brush
- To reduce the risk of injury from falling objects do not cut vertically above your head.
- Try not to drop branches onto the roadway.
- Stay two tree-lengths distance from other workers.
- Always plan and have a retreat path.
- Despite all precautions “kickback” can occur while using a pole saw.
- In steep or uneven terrain, operators can slip or stumble while using pole saws.
- Operators fatigue after only a few hours of work after which the risk of accident increases.

### **Iowa Summary**

- 22 counties report using telescopic pruning saws.

### **Purchasing**

- Businesses listed reflect survey data.

Telescopic Pruning Saws  
Stihl Incorporated  
536 Viking Drive  
Virginia Beach, VA 23452  
800 467-8445

Pole Saw  
Husqvarna Forest & Garden Co.  
9006 Perimeter Woods Drive  
Charlotte, NC 28216  
704 597-5000

### 3.10 Aerial Lift Trucks or “Bucket Trucks”



(GMN 2002)

An aerial lift truck or “bucket truck.” Typical is the 1987 Ford F700 truck owned by Buchanan County. That truck carries an array of boxes and supports a Holan (now MTI Insulated Products) Bronco Aerial Lift Model 83 that extends 36 feet. The single man basket (bucket) is rated for a work load of 300 lbs.

#### Application

- The bucket truck is used to gain access to areas limited by height or steeper grades where the road shoulder steepness limits foot access.
- A bucket truck deploys an arm supporting a bucket that can safely carry an employee.
- Using a bucket truck, a work crew can remove problem limbs that overhang a road without removing an entire tree.

#### Issues

- Bucket trucks are custom designed products built by truck outfitting companies.
- The supplier begins with a truck chassis (for example a Ford F700) and depending on the needs of the client, adds fiberglass tool boxes and an aerial lift.
- For tree pruning, a lift that extends 50-55 ft is recommended.

#### Safety

- Employees using bucket trucks should never work alone.
- When working above ground, all employees shall wear a properly fitting harness that tethers the worker to the aerial lift.
- Before raising an aerial lift, supports should be deployed that properly stabilize the supporting truck.
- Electrocution Hazard
  - Approaching or contacting electric power lines may cause serious injury or death from electrocution.
  - Electricity can jump from one point to another by means of arcing and/or may be conducted through damp branches.
  - Maintain a clearance of at least 50 feet (15 M) between tools and any electrical line carrying a live current.

#### Important

Employees should not be lifted in equipment that is not designed for

**Iowa Summary**

- 4 counties report using a bucket truck.\*
- It comprises about 5% of their brush control effort.

\*Casual data, use is probably more widespread.

**Purchasing**

- Businesses listed reflect survey data.

Hi-Ranger  
Terex Telect  
600 Oakwood Road  
P.O. Box 1150  
Watertown, SD 57201  
605 882-4000

Versalift  
TIME Manufacturing  
P.O. Box 521000  
Longwood Florida 32752  
254 399-2125

Holan/MTI Insulated Equipment  
PO Box 9247  
9733 Indianapolis Road  
Fort Wayne, Indiana 46809  
800 860-5438

### 3.11 Boom Mowers



(Tiger)

A side mounted Tiger TRB-50C rotary boom mower supported by a John Deere Tractor (most common is a John Deere 7410 MFWD tractor (105 hp).

*“The kind of boom mower operator makes all the difference. If you take your time, the mower works well.”*

– Michael Saltzgaver  
Roadside Manage  
Lee County

#### Application

- Boom mowers in Iowa are usually mid-mounted on a farm tractor, though a few models are end mounted.
- A single operator can trim many miles of road in a day.
- The boom mower is used to trim tree branches and brush that overhang roadways and clear zones.
- Boom mowers can be used to mulch the cuttings, so little clean-up is required.

#### Issues

- Cut branches are splintered and unsightly.
  - This often results in public complaints from well-traveled areas.
  - Because of this, boom mowers are often restricted to gravel roads.
- Cutting in highly visible areas can be dressed by pruning stumps and stubs with a chain saw.
- Cut limbs and stumps often produce multiple sprouts.
  - Stump treating after cutting can help reduce this problem.
  - Washington County has rigged spray nozzles that can treat boom-cut stumps remotely.
  - In the near future, Diamond has plans to produce a self-treating boom mower blade (<[www.wetblade.com](http://www.wetblade.com)>) that treats stumps as it cuts.
- Many complain that tractors used to support boom mowers are often lightweight or underpowered.
  - To correct this complaint, John Deere recommends a full-size crop tractor with a PTO horsepower rating between 95 and 105 to support a boom mower.
  - Adding a 4-wheel drive “MFWD” option is also helpful.
  - Underpowered tractors are often older utility tractors with lower PTO horsepower ratings.
- The maximum diameter log that can be cut with this equipment is 3-4 inches.

*“Overall, the boom mower is a poor finish trimmer. We go back immediately after we mow and finish the job with chain saws so that there aren’t any problems. It still is better than using the Trac Hoe to rip branches off the trees, which was the former method. While using that method, one township almost came unglued from negative public reaction.”*

– Steve Struble  
Engineer  
O’Brien County

- Inexperienced operators often try to cut heavier wood, damaging the mower.
- In many counties this equipment is often in the shop for repairs.
- For cutting and mulching light brush, a grass blade may be superior to a brush blade.
  - Added benefit: Can be used to mow weeds a rotary grass mower can't reach.
  - The blade require more frequent sharpening.
- Recommended mowing technique to help reduce damage is to mow from the top of a tree towards the ground.

*“The boom mower hasn’t worked well for us. Crews tend to use it on trees that are too large, or if mowing trees, try to mulch the tree rather than taking it to the chipper. In addition, fence lines get ripped up inside the boom mower. After 5 years, we’re getting better at mowing. Its about trying to find the right guy to run the mower.”*

– Steve Gannon  
Engineer  
&

– Rob Roman  
Roadside Manager  
Linn County

### **Safety**

- Debris can often be thrown some distance.
- The boom should be aimed away from roadway and homes.
- Crews should stand clear to avoid being struck by debris.
- To protect the operator against parts that may break and exit the boom mower at high velocity, consider:
  - reinforcing metal on the mowing side of the cab
  - replacing cab glass with shatter-resistant Lexan

### **Iowa Summary**

- 50 Counties own a total of 67 boom mowers.
  - It comprises about 36% of their brush control effort.
  - Most common boom mower: Tiger TRB-50C
    - Average head length 51.6"
    - Average boom reach 20.6'
  - Most common supporting tractor: John Deere 7410 tractor; MFWD optional (105 hp)
    - Average power at PTO 91.5 hp\*
- \*underpowered! (95-105 hp recommended)*

### **Purchasing**

- Purchasing a boom mower usually means purchasing a “system” mounted to a tractor that will support a number of other attachments: grass mowers, ditcher, road drag, etc.
- Businesses listed are for the boom mower table in Appendix B.

Alamo Industrial  
1502 East Walnut  
Seguin, TX 78155  
800 882-5762

Diamond  
27134 Parkland Drive  
Sioux Falls, SD 57106  
800 658-5561

Bomford Turner Limited  
Salford Priors Evesham  
Worcestershire  
WR11 8SW England  
Telephone: 01789 773383

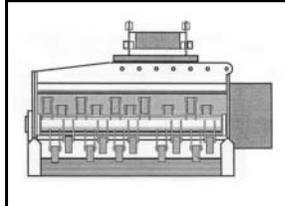
Tiger Corporation  
3301 North Louise Avenue  
Sioux Falls, SD 57107  
800 843-6849

### 3.12 Brush Cutters



(Pro Mac)

A Pro Mac rotary brush cutter powered by a caterpillar track excavator. In Iowa, the most common is a Weldco-Beales ERC48 Rotary Brush Cutter.



(Pro Mac)

Sketch of flail hammers inside a brush cutting head. Other heads have rotary cutters.

#### Application

- Used to mulch large branches or entire trees that overhang roadways and clear zones.
- Usually mounted on the arm of a wheel or track excavator.
- A single operator can trim many miles of road in a day.
- Can be used to mulch what it cuts, but debris is often thrown great distances.
  - Considerable clean up may be required.

#### Issues

- Cut branches are splintered and unsightly.
  - This often results in public complaints from well-traveled areas.
  - Because of this, brush cutters are often restricted to gravel roads.
- Cutting in highly visible areas can be dressed by pruning stumps and stubs with a chain saw.
- Cut limbs and stumps often produce multiple sprouts.
  - Stump treating after cutting can help reduce this problem.
- Wheel excavators are restricted to roadways, while track excavators can be driven down into the ditch.
- Wheel excavator arms need to extend outwards 30 feet to reach the edge of the clear zone.

#### Safety

- Debris can often be thrown some distance.
- The cutting head should not be used near homes.
- Crews should stand well clear to avoid being struck by debris.
- To protect the operator against parts that may break and exit the brush cutter at high velocity, consider:
  - reinforcing metal on mowing side of cab
  - replacing cab glass with shatter-resistant Lexan

*“Broken blades weigh 50 pounds and if thrown by equipment, can travel almost a quarter of a mile.”*

– Michael Olson  
Engineer  
Jasper County

**Iowa Summary**

- 17 counties own a total of 18 brush cutters
- Most common brush cutter:
  - Weldco-Beales ERC48 Rotary Brush Cutter
    - average head length 51.5"
- Most common supporting excavator:
  - Caterpillar M318 Wheel Excavator
    - average reach 26.7'

*“The quality of work produced by brush cutters depends on the operator. If somebody gets carried away and goes fast, it looks bad. The quality depends on the person operating the machinery.”*

– Todd Hagan  
Engineer  
Madison County

**Purchasing**

- Businesses listed are for the brush cutter table in Appendix B.

Gregory (Roanoke)  
P O Box 269  
506 Oak Drive  
Lewiston-Woodville, NC 27849  
252 348-2531

Pro Mac  
2940 Jacob Road  
Duncan, British Columbia V9L 6W4  
Canada  
800 665-5405

Seppi M  
Carlson Tractor & Equipment Co.  
14375 James Road  
Rogers, Minnesota 55068  
Phone: 800 642-4441

Wag Way Bird Eye  
483 N. Mount Zion Rd.  
Vincennes, IN 47591  
800 992-4929

Weldco-Beales  
1850 Marine View Drive  
Tacoma, WA 98422  
800 547-6357

### 3.13 The Limb Lopper



(Roger Schletzbaum)

Marion County.  
The hydraulic “Limb Lopper” was designed and built by Tim Van Roekel and Mark Fee.

#### Application

- The Limb Lopper is used to prune high overhanging branches.
- The head attaches to an XL4100 Grade All Telescope.
- Effective at eliminating overhanging branches up to 6 inches in diameter. A harder cutting edge might extend this range.

#### Issues

- The Limb Lopper is a prototype.
- The Lopper was developed to replace the unsafe practice of employees who would prune overhead branches while standing in the buckets of other equipment that were designed for aerial lifting.
- The county estimates that another Limb Lopper could be built in house for \$600-700 of material in 50 hours.
  - Gradeall is planning to offer a cutting head based on this design at under \$5,000.
- Plans are available from the Marion County engineer’s office (641 828-2225).

*“We made short work of most of the high overhanging brush around the county. Now we use the Lopper to clear access to work projects. We are planning to add the Lopper to the rest of the Telescope fleet.”*

– Roger Schletzbaum  
Engineer  
Marion County

## REMOVING A PLANT BY ITS ROOTS

### 3.14 Grubbing



(Louis Eberhardt)

Clayton County.

A Daewoo Solar 200W-III wheel excavator supports a combination Wag Way Bird Eye 44 inch brush cutter and FLCO hydraulic thumb.

#### Application

- Grubbing, usually with bucket equipment, is fast and often permanently removes a plant.
  - Single trees are removed by digging around the root ball, then lifting the tree from the soil.
    - Trees on private property are sometimes removed if they are causing snow and ice problem on the roadway.
    - Written permission is usually first obtained from a landowner.
  - Plum thickets with their brittle stems, tangled growth and sharp thorns, are removed by smashing them with a backhoe or excavator bucket, raking the remaining stems to break them off, then piling and burning the slash.
    - Thickets are usually cleared during winter months.
    - Adding a thumb to the backhoe increases the efficiency of this process.
    - Resprouting thickets are foliar sprayed.

#### Issues

- Grubbing a stump out by the roots disturbs the soil and can result in:
  - soil erosion
  - reseeding costs
  - future noxious weed management
  - destruction of prairie remnants
- If these issues are a concern, an easy solution is to cut the tree flush with the soil surface and stump treat.

#### Iowa Summary

- 10 counties grub plants on a regular basis.
- It comprises about 13% of their brush control effort.
- Equipment commonly used to grub out plants:
  - Excavator used an average of 57.9% of the time
  - Backhoe-Loader used an average of 26.3% of the time
  - Loader used an average of 10.5% of the time
  - Bulldozer used an average of 5.3% of the time

### 3.15 Heavy Equipment



(Scott Nixon)

Union County.  
Before and after photos of  
vegetation management. Heavy  
equipment was used to remove  
brush and flatten the banks.



#### Application

- Heavy equipment pictured is ranked left to right in decreasing order of popularity.
- Often the method of last resort, though it may be gaining popularity with expanding brush and shrinking budgets.
- The fastest way of eliminating heavy stands of brush in the clear zone.
- The use of heavy equipment may permanently destroy highly conservative rootstocks of native plants.
- Common reasons for using heavy equipment to clear a right-of-way:
  - Road is already a construction site.
  - Brush is causing drainage problems
  - Trees become so extensive that you'd have to spend too much time and money hand cutting and too large to spray and...
  - Clear zone visibility is threatened.
  - Brush is causing chronic ice and snow problems because of shading or snow drifting
- Especially useful for rock road and dirt road upgrades.
- Simultaneously uproots and removes brush, cleans the ditch, restores drainage, flattens the banks, and makes the roadway easier to maintain.
- Flattening the banks often encourages a landowner to mow. If the landowner cooperates, then future brush problems are eliminated.
- The process is often initiated by landowners who want to build a new fence or field access.
- Of those counties with limited budgets and heavy tree growth, the use of heavy equipment may be a preferred option.
- Bulldozed brush is usually piled and burned.

*“It is more economical to flatten a bank and remove trees rather than repeatedly pushing snow and ice off a roadway.”*

– Brian Keierleber  
Engineer

## Issues

- Reseeding a reclaimed clear zone is recommended:
  - Pasture/ditch mixes of brome and annual rye are available from many local elevators.
  - If funding is available, consider a custom seed mix appropriate to a particular site.
  - Groups such as Pheasants Forever often provide money for conservation reseeding.
- Assess rights of ways for prairie remnants before heavy equipment is used.
  - Be prepared to consider alternate or integrated control measures if a road section is found to contain a fair amount of prairie.
  - It is ironic that one county may have an elaborate roadside program and allocate scarce funding to purchase and sow native seed, while an adjacent county may advocate the use of heavy equipment to remove brush and inadvertently destroy conservative, high quality prairie remnants.

## Safety

- Only qualified people should operate equipment.
- Learn the location and purpose of all controls, instruments, indicators, and labels.
- Know and follow established service procedures.
  - Low mileage vehicles – change oil within six months period
  - Heavy equipment – 100 hours and as required by working conditions
  - Dump trucks – 3000 miles or 180 days
- When making checks with engine running, always have two people present.
  - The operator at the controls must be able to see the person performing checks.
  - Keep hands away from moving parts.
  - Wear protective clothing and PPE:
    - Safety glasses
    - Hearing protection
    - Hard hat
    - Gloves and dust mask when necessary
- Operators will check all fluid levels, safety equipment, and fire equipment before operating.
- Check for leaking fuel lines, hydraulic lines, hoses, or fittings.
- Remove trash from guards, drive line, batteries, hydraulic lines, fuel tank and operator's station.
- Use hand holds and keep decks and steps free of oil or refuse.
- Operate machines in a safe manner avoiding hazards, such as power lines.
- Use seat belt and other safety equipment as needed.
- Before moving equipment, be sure all persons are away from machine.
- When a machine is in use only the operator should be on it.
- When working in brush, watch out for falling trees.
  - These can cause injury and damage equipment.
- Clean the machine regularly.
  - Remove any grease, oil or debris build-up to avoid possible injury or machine damage.

*“When using bulldozers and excavators to remove trees, the biggest danger is not paying attention when a tree falls. It can damage equipment or cause an accident.”*

– Lee Bjerke  
Engineer  
Winneshiek County

- Park safely and be sure all mechanisms are resting on the ground or in locked-in position.
  - Before leaving operator’s seat, be sure machine will not move.
  - Remove keys from switches, lock all shields, and fuel tank.

### Iowa Summary

- 25 Counties use heavy equipment to control brush.
- It comprises an average of 21% of their brush control effort.
- There are 3 approaches to using heavy equipment:
  - Roadway geometrics calls for a road to be widened or a bank to be reshaped to eliminate a snow trap. Brush removal is incidental.
    - 2 counties.
  - Heavy equipment is a means of last resort to control brush. Within a county program, use of heavy equipment rates 5% or less of total brush control effort.
    - 7 counties.
  - Heavy equipment is a convenient method to control brush. Within a county program, use of heavy equipment rates >5% of total brush control effort and may top 70%. A county may reimburse a landowner who hires a private contractor to control brush.
    - 16 counties

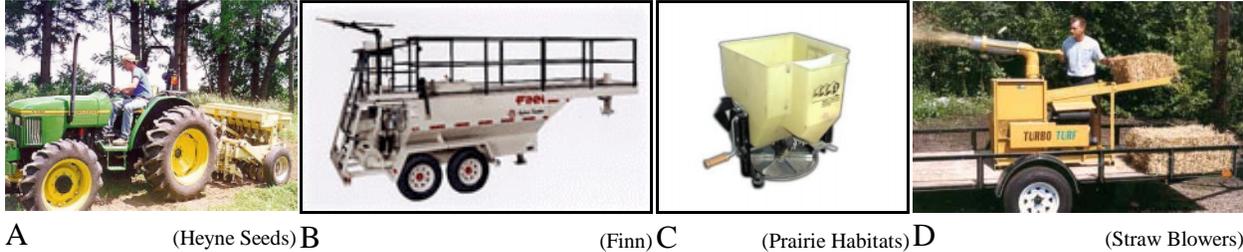
*“This method is the quickest, easiest, and most effective way to remove brush. Some roads reach a point where you’d have to spend too much time hand cutting, and the trees become so large that you can’t spray either. In addition, this method has the added benefits of ditch cleaning and bank reshaping.”*

–Eldon Rike  
Engineer  
Adams County

### Equipment Used

- Bulldozer used an average of 57.9% of the time
  - Cat D6 16 counties
  - Cat D5 5 counties
  - Cat D7 4 counties
- Excavator used an average of 26.3% of the time
- Motor Grater used an average of 7.0% of the time
- Loader used an average of 3.5% of the time
- Scraper used an average of 3.5% of the time
- Crane used an average of 1.8% of the time

### 3.16 Mechanical Seeding



- A. Native Seed Drills are preferred equipment for roadside prairie reconstructions where clear zone geometrics permit access.
- B. Hydroseeders can be used for seeding projects in clear zones with uneven terrain.
- C. Most seed broadcasters used by Iowa counties are electrified and mount on the back of a truck or tractor. Follow up treatment is usually with a roller or harrow to improve seed to soil contact.
- D. Straw blowers are sometimes used to cover seeding treatments.

#### Application

- Seeding is an important method often overlooked in brush control.
- It is the first step in reclaiming a site disturbed by heavy equipment for the purposes of tree and brush removal.
  - Soil disturbance often exposes a fresh crop of weed and tree seeds from the seed bank.
  - If germination safe sites are not taken up by a planted crop, weeds and tree saplings will reestablish almost immediately.
  - If conservation seed is available, this is a good time to plant.
- Once an area dominated by trees and brush is converted to grasses and forbs, it can be managed by mowing or prescribed burning.
- Seeding methods are limited by:
  - Roadside terrain.
    - If ditch slopes are flat enough, tractor pulled drill seeders are the preferred method of seeding.
    - Broadcast seeders are an alternative method if terrain allows access, but seed must be raked, harrowed, or cultipaked (rolled) to improve seed to soil contact.
    - Hydroseeders work well for seeding irregular ground.
  - Equipment.
    - Drill seeders are offered in ever smaller sizes.
      - One model seen at a recent trade show, only several rows wide, was powered by an ATV.
    - Hydromulchers support water tanks with capacities that range from hundreds to thousands of gallons.
    - Broadcast seeders come in small, medium, and large sizes: hand carried, tractor mounted, or as trailers drawn behind tractors.

*“In the future, I hope to use native grass as a brush control method.”*

– Duane Stohlmann  
Roadside Manager  
Iowa County

- Weather and season.
  - Native plant seeds can be sown in almost any condition and any season.
  - Any seed should be dry sown if planting in fall, winter, or early spring before the danger of frost is past.
  - Mixes containing cool-season plants such as smooth brome and clover are best planted in spring and fall when adequate moisture is available.
- Budget.
  - Seeding can be simple or elaborate depending on funding available.
- Contracts.
  - A few counties give seed to the landowner to plant after an area is cleared of trees and brush.
    - Most farmers use drill seeders to plant.
  - Contracts may specify seed types, or restrict options that arise later.
- Seed.
  - Most popular is the “ditch/pasture mix” of smooth brome and annual rye or oats. available from the local elevator.
  - Native seed mixes becoming popular.
    - Some conservation mixes become quite elaborate.
    - Limited by budget and supplying source.
    - Notes on native seed.
- Seed handling notes.
  - Non-natives.
    - Mix seed with mulch and apply.
    - Oats must be applied quickly or the seeds will imbibe too much water and turn into oatmeal.
  - Native grasses.
    - Drill seeders are most popular for seeding native grass.
    - Forb seed may need to be debarbed before planting.
  - Native forbs.
    - If using hydromulchers, apply seed with water or with mulch at 1/4 of the regular mulch rate.
    - Cover seeded areas with straw or a regular layer or hydromulch.
      - Hydromulch is a weed seed-free medium.
  - Native mixes.
    - If drill planting, tiny forb seeds tend to sink to the bottom of the hopper, get planted first, and are often exhausted after the first half planting.
    - If hydromulching, one manager reports that heavy mulch delays forb establishment by several years.
    - A different manager observes that after 10 years, both hydromulching and drill seeding produce excellent stands of native plants.
    - Drill seeding uses less seed/acre.

*“When we ask farmers what seed mix they want, 60% say the ditch/pasture mix while 40% say natives. Then they check with their wives and 10% switch to natives, so that 50% of what we plant is native mixes.”*

– Wayne Thornsberry  
Assistant Engineer  
Van Buren County

- Do not use broadcasters to plant grass/forb mixes, since seed winnows by weight and species become planted in uneven rows.

### **Safety**

- Wear protective clothing and PPE:
  - Safety glasses
  - Hearing protection
  - Hard hat
  - Gloves and dust mask when necessary
- Observe towing safety
- Never operate equipment alone.
- For hydromulchers and straw blowers, aim discharge chute in a safe direction and away from buildings, bystanders and operators.

### **Iowa Summary**

- 9 counties report using one or more types of reseeding equipment.
- Equipment used\*
  - broadcast seeder 6 counties
    - Variety of manufacturers: Truax, Thompson, Herd.
    - All are mid-sized electric seeders that mount on a 3-point tractor hitch.
  - drill seeder 4 counties
    - Most common: Truax Flex-88 Drill
  - hydroseeder 4 counties
    - Most common: Finn T-120 Hydroseeder
  - buggy seeder 2 counties
    - No details available
  - straw blower 1 county
    - No details available

\*Casual data, use is probably more widespread.

### **Purchasing**

- Businesses listed reflect survey data.

Herd Seeder Company  
2383 South US 35  
P.O. Box 448  
Logansport, IN 46947  
574 753-6311

Thompson Seeder Company  
2383 South U.S. 35  
PO Box 776  
Logansport, In. 46947  
574 753-6366

Finn Corporation  
9281 LeSaint Drive  
Fairfield, OH 45014  
800 543-7166

Truax Company  
4821 Xerxes Avenue North  
Minneapolis, MN 55430  
763 537-6639

## BRUSH DISPOSAL

### 3.17 Brush Disposal



A.

(Josh Finley)



B.

(Brian Ridenour)

A. Cerro Gordo County.

A work crew chips brush into a dump truck using a Morbark model 17 chipper.

B. Allamakee County.

A single operator chips brush into the ditch using a Bandit model 1900 whole tree chipper and feeding grapple.

### Iowa Summary

- After cutting, roadside brush is most commonly disposed of by chipping, burning, or leaving in the ditch. The list below ranks methods of brush disposal by percent.

26.6 Chipped (or mulched by mower) and left on the ground

21.5 Burned on site

- often stacked for burning by heavy equipment

20.5 Left in the ditch

13.8 Chipped and hauled away

5.3 Hauled away and burned

4.7 Removed as firewood

- occasionally removed as lumber

3.1 Not cut, but foliar sprayed and let stand dead

2.8 Hauled away without chipping

1.0 Left in piles

- erosion control
- wildlife habitat
- land owner may dispose of these piles later

0.7 Buried

- especially roots (brush that won't burn)

- 68 counties in Iowa use a chipper to dispose of cut brush.
- A tally of counties ranks the popularity of chipper manufacturers

39 Vermeer

30 Morbark

2 Badger

2 Bandit

1 M&M

4 Unknown

*“If the trunk diameter is under 4 inches, we chip. If over 4 inches, we cut and leave in the ditch. It is common knowledge that this wood is available as firewood and it often disappears.”*

– Tom Goff  
Engineer  
Jefferson County

- Average diameter log chipped 10 inches
- Average diameter range 6-12 inches

*“A brush pile in the road ditch is as big a hazard as a tree.”*

– Chris Snyder  
Roadside Manager  
Mahaska County

**Chipper Safety** (Morbark 2002)

- Brush intake rate should be slow and steady.
  - Do not use any chipper that violently grabs brush.
  - Most new chippers have an automatic feed.
- Wear proper clothing
  - Clothing should be close fitting and tucked in.
  - Do not wear loose fitting clothing like scarves and untucked or unbuttoned shirts and jackets, and pants with cuffs.
  - Do not wear jewelry, rings, watches or necklaces.
  - Remove saddlebag, body belt or harness before operating the chipper.
- Wear OSHA approved protective equipment
  - hard hat
  - ear protection
  - eye protection
  - sturdy work pants
  - hard-toe work boots with non-slip soles
  - gloves (Snag risk: No gauntlet style gloves)
- Have a fire extinguisher available.
- Observe towing safety
- Before using:
  - Read and understand all safety information in the operator’s manual provided with their chipper.
  - Perform a walk around inspection of the machine.
  - Aim discharge chute in a safe direction and away from buildings, bystanders and operators.
  - Block wheels
- During operation:
  - Never operate the chipper alone.
  - Only chip at full throttle.
  - Do not operate under trees.
  - Operate only on level ground.
  - Examine the brush pile for foreign objects before chipping.
    - Rocks, metal and other non-wood materials if fed into a chipper will cause damage to the machinery and can become projectiles.
  - Feeding brush
    - Stack brush far enough from the chipper to allow the operator a clear path.
    - Feed the brush into the chipper butt-end first.
    - Never place feet or hands in the infeed chute while the machine is running.
    - Never kick brush into the infeed chute while the machine is running.
    - To safely feed short material, always lay the short material on top of longer material that is feeding.

- Never feed handfuls of twigs, leaves and other material that has been raked up.
- Never unclog a chipper or perform maintenance while the chipper is running.
- Remove the ignition key when the machine is left unattended.

**Incident Report: A tree trimmer dies when pulled into in a brush chipper.**

July 15, 2000 (CA FACE 2001)

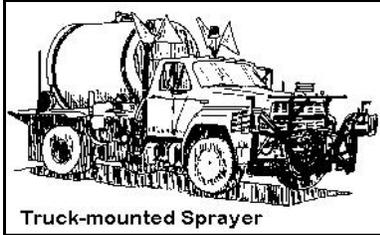
A 33 year-old male tree trimmer died when pulled into a brush chipper at a job site. The decedent was chipping small and medium size tree limbs being piled by other workers around the perimeter of a job site. The decedent was working alone at the brush chipper. Co-workers said they heard a strange noise come from the brush chipper. The supervisor on the job went to investigate, discovered the decedent's remains, and immediately called 911. Although the incident was unwitnessed, police concluded that the victim either lost his balance while feeding material into the chipper or was leaning across the feed table pushing trimmings into the feed chute when his gloves were caught by the feed rollers and he was pulled through the chipper blades. The cause of death, according to the autopsy report, was total body fragmentation.

**References**

- [CA FACE] California Fatality Assessment and Control Evaluation Program. 2001. A tree trimmer dies when pulled into a brush chipper. In: Oakland, CA: CA FACE Program. Report nr 00CA010. <<http://www.dhs.cahwnet.gov/ohb/OHSEP/FACE/00CA010.htm>>. Accessed 2002 Jul 25.
- Morbark. 2002. Brush chipper maintenance and safety information. In: Morbark online. Winn, MI: Morbark. <[http://www.morbark.com/equipment\\_specs/brush\\_chipper\\_maintenance\\_tips.htm#Safety%20Inf](http://www.morbark.com/equipment_specs/brush_chipper_maintenance_tips.htm#Safety%20Inf)>. Accessed 2002 Jul 25.

## SECTION 4 – CHEMICAL BRUSH CONTROL

### 4.1 Methods of Chemical Brush Control



Truck-mounted Sprayer

(Steve Holland)

Section 317.11 of the Iowa Code states: "Spraying for control of noxious weeds shall be limited to those circumstances when it is not practical to mow or otherwise control the noxious weeds."

#### Applications

- Three are three kinds of chemical brush control used in Iowa counties:
  - foliar spray
  - basal bark spray
  - cut stump treatment
- Common products applied:
  - fosamine ammonium (Krenite)
  - triclopyr (Garlon, Pathfinder & others)
  - 2,4-D (many formulations)
  - metsulfuron-methyl (Escort)
  - picloram (Tordon) (predominantly used to treat cut stumps)
  - several others, mostly used in combination

#### Did You Know?

While a source of water contamination and detriment to roadside wildflowers, blanket spraying had one benefit: It helped to suppress roadside woody plant growth.

#### History

- The development of 2,4-D during World War II ushered in the era of chemical control for weeds and brush along roadsides.
- Initially, blanket spraying was the only method available for roadside chemical brush control.
- This method left a lot to be desired.
  - Blanket spray was a non-specific method of controlling brush.
  - It promoted an endless cycle of weeds-and-spray by eliminating desirable non-target plant communities along with target weeds and brush.
    - Free from the competition of long-lived perennial prairie plants, weedy annuals and short-lived perennials dominate roadside ditches.
  - Little variety in chemical products were available. Early formulations such as agent orange were dangerous to handle because they contained carcinogens such as dioxin and volatilized easily, readily damaging non-target plants.
- Adoption of Integrated Roadside Vegetation Management by most counties eliminated blanket spraying in favor of spot spraying. As of this writing, only one county in Iowa still blanket sprays.
- This spared many prairie plant communities from continuous assault but also allowed tree seedlings to grow, hence the need for this handbook.

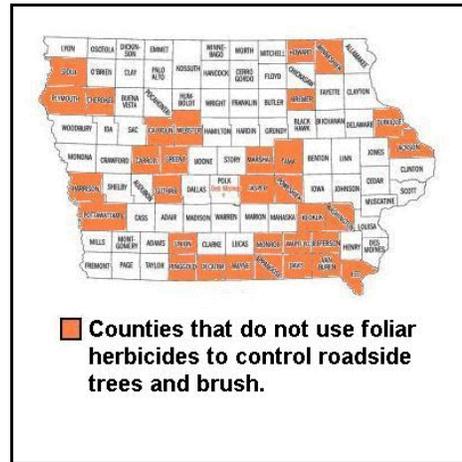
## Issues

- Always follow label directions.
- 1/3 of Iowa counties use no foliar chemical products.
  - Half of those counties discontinued programs after being sued for crop loss or personal injury by workers or affected residents.
  - A few have begun experimenting with ready-to-use (RTU) products.

**Important**

Product drift is the number one concern of all managers still applying herbicides.

- Most herbicide products, unless sold over the shelf in supermarkets or designated RTU, can only be applied by licensed applicators.
- In addition, many of the piclorams are further limited as restricted use pesticides. The purchase of this material requires special registration.



- *Appendix D – Record Keeping: 1. Documenting Herbicide Application* offers a sample form used by Muscatine County.
  - Data sheets (8.5 x 11) collect application information on the front.
  - Township maps on the back can be marked with highlighters to note where work was done on a given day.
- If handled improperly, many of these products have the potential to inflict injury to applicators and support personnel.
- No product should be used in a ditch that is likely to leach from the soil before it decomposes, since it may later migrate from the site and come in contact with the roots of desirable plants elsewhere.
- Basal bark treatment with RTU technology looks very promising as an integrated method for controlling resprout of trees with minimum risk to applicators.

## Sensitive Areas

- A list of non-target areas many cite as easily affected by chemical herbicides.
  - row crops
    - almost always results in lawsuits or financial settlements
  - organic farms
    - a growing industry in many otherwise low row crop counties
    - these landowners are very concerned about accidental crop contamination from herbicides.
  - windbreaks
  - bees & nearby flower sources
  - homes & yards
  - flower and vegetable gardens
  - landscape trees
  - pets

Section 4 – Chemical Brush Control

- human health
  - asthma
  - bronchitis
- prairie remnants & reconstructed prairies
- decorative flowers planted in the ditch
- other plant communities

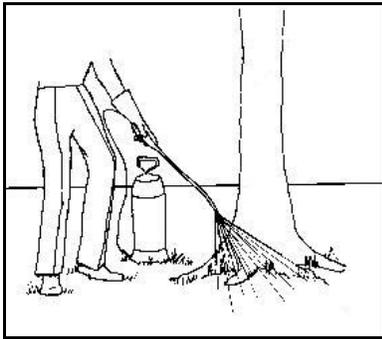
*“We’ve just about dropped our spray program because of environmental concerns. Stump treating is much more acceptable to the public.”*

– Mose Bear  
Technician 4  
Lucas County

*“There are 35,000 rural residents in Linn County with plenty of people who do not want us to spray. Oddly there are lawn services where people come out and spray, but we don’t spray in front of people’s houses. We encourage those people to mow.”*

– Steve Gannon  
Engineer  
&  
– Rob Roman  
Roadside Manager  
Linn County

## 4.2 Safety



(Steve Holland)

- Federal and State law requires that all people who purchase and apply restricted use pesticides and any applicator who applies pesticides for hire be certified according to established standards.
- Information on applicator licensing can be obtained from:
  - Iowa Department of Agriculture and Land Stewardship
  - Pesticide Bureau
  - Wallace State Office Building
  - 502 East 9<sup>th</sup> Street
  - Des Moines, IA 50319
  - 515 281-5601

### Safety Tips

- ALWAYS READ THE LABEL.
- Warning Labels (level of risk):
  - Caution: Product is slightly toxic to humans.
  - Warning: Considered toxic.
  - Danger: Extremely toxic.
- Before handling products or mixing, read the label to make sure you're wearing all proper safety equipment.
- Personal Protective Equipment (PPE):
  - Wear clean clothes: long sleeve shirt, long pants, & chemical-resistant coveralls.
  - Wear goggles and/or safety glasses to protect eyes.
  - Wear cap or hard-hat to protect head.
  - Wear heavy rubber gloves.
  - Never use cloth gloves.
    - Tuck gloves inside your shirt sleeves as barrier against contamination.
    - Wash gloves with soap and water after every use to allow reuse.
    - Latex gloves can be used, but must be discarded after every use.
- The herbicide storage facility:
  - Should be secured against vandalism and theft.
  - Should prevent accidental exposure to animals.
  - Should be properly ventilated.

- **Chemical Handling**
  - Keep herbicides in original, labeled containers.
  - Consider using dry powders.
    - They are just as effective, but much less hazardous.
  - Don't carry herbicides in the cab of a truck.
  - Always mix upwind & uphill of materials.
  - Make sure your head is well above the level of mixing to protect face & head against splashing.
- **After Handling**
  - Triple rinse any measuring cups.
    - Wash rinsate into mixture.
  - After emptying a dry product from a paper bag, fold the bag and place it inside a sealable *Ziplock* bag.
  - Render useless any plastic container that is left & dispose of properly.
- **Spills**
  - For ground spills, carry kitty litter to soak up excess.
  - If the spill is large, contact the appropriate authority.
    - There may be special instructions for clean up.
  - Clean up any spill immediately.
  - All waste material from a spill should be sealed inside paint can-style containers and labeled for proper disposal.

### **Poisoning**

- Have the poison control center phone number available.
  - Different companies subscribe to different poison control phone services.
  - If poisoning is suspected, do not wait for symptoms to develop. Contact a physician, the nearest hospital, or the nearest Poison Control Center.
- Always carry Material Safety Data Sheets (MSDS) and be able to provide the empty container to emergency personnel.
- In this book, emergency contact numbers are listed by product manufacturer.

### **If Contamination Occurs**

- If skin is affected, wash hands and skin with soap and water.
  - If clothes are lightly contaminated, put on clean clothes
  - If clothes are soaked, get to a shower facility.
- If eyes are affected, flush them with water for 15 minutes and immediately seek medical attention.
  - Install an eye wash station in the main work area.
  - Away from this station, keep large bottles of eye-wash solution handy in the event that eyes are affected.
- If lungs are affected, move to a place of fresh air.

### How to avoid poisoning

- At work
  - Always wear PPE.
  - Never apply a product when you have cuts or abrasions on your person.
  - Do not eat, drink, or smoking around chemicals.
  - Wash hands thoroughly before eating & restroom use.
  - Wash work clothes at the end of each day.
- At home
  - Wash soiled clothing separately from household laundry.
  - Wash according to warning product label hierarchy:
    - If *Caution*: Wash separately 2-3 times, then rinse washer through 1 complete empty cycle.
    - If *Warning*: Wash separately 2-3 times, then rinse washer several cycles.
    - If *Danger*: Use chemical resistant gloves, dispose of clothes in sealed plastic bag. Do not wear clothing again.

### References

DowElanco. No date. Treatment options for rights-of-way: making the choice.  
Form nr 350-00-042. Video (11:30 min).

Terra International. 1996 Jan. Vegetation management (revised): safety procedures and treatment methods. Video (25:21 min).

### 4.3 Foliar Spray



(Greg Schmitt)

Buchanan County.

*“It’s often best to spray trees when they’re young, before local residents have had a chance to bond with them.”*

– Brian Keierleber, Buchanan County Engineer

Warren Lucas applies a mixture of Garlon 4 and 2,4-D to roadside brush.

- Foliar spray contains a diverse group of chemical products that can be used to produce specific results.
- Currently two-thirds of Iowa’s counties use foliar sprays to help control roadside trees and brush.
- One-third do not use, or have discontinued use of foliar sprays.
  - Most managers in counties with canceled spray programs cite one of three reasons why the program was ended:
    - successful herbicide drift damage law suits
    - employee claims of injury from accidents
    - too much negative public reaction to foliar spray

#### Issues

- Before spraying
  - The label is the law. **READ THE LABEL CAREFULLY.**
  - Store chemicals properly.
  - Keep application equipment maintained properly.
  - A few products are restricted use and can only be applied by licensed applicators.
  - Spray duties may be split between a roadside manager (licensed foliar spray) and the road crew (RTU cut stump treatments).
- Spraying
  - The industry describes two methods of control:
    - **Low volume foliar spray.** Crews use backpack or handheld sprayers to treat the foliage of target trees with a light coating of herbicide on the leaves. This method reduces off target damage and is commonly used in areas of lower vegetation density.
    - **High volume foliar spray.** Crews use mechanical powered sprayers to treat the foliage of target trees with volumes of herbicide ranging from 25-150 gallons per acre. The applicator must be careful to cover the target adequately while avoiding over spray onto nontarget vegetation. This method is commonly used in areas of higher vegetation density and is the most weather dependent of all chemical control methods.

- Tailor the product applied to the situation.
  - Avoid one-size-fits-all herbicide applications.
- Never apply a product in the ditch that can leach. Ditches are by definition intermittent waterways.
- Do not apply near sensitive areas (see 4.1).
- Limit foliar spray to less trafficked areas.
  - Most foliar sprays produce dead and dying trees.
  - Subsequent browned vegetation is unsightly and results in bad public relations.
- Apply only under label specified conditions for temperature and wind.
  - Be aware of hot microclimates that may spike above ambient temperatures:
    - Rocky areas
    - South and west-facing hillsides.
- Limit most spray to small trees (6-8 ft tall) and brush.
  - This reduces the possibility of herbicide drift onto nontarget vegetation.
  - Helps avoid any subsequent lawsuits.
- After Spraying
  - Foliar products are not 100% effective.
    - Many products reported to be seasonally ineffective.
    - Plants may be left stunted but alive.
    - Plants may only be killed on one side if coverage is not complete.
  - Some managers complain that even if a good kill is achieved, it leaves a dead carcass that still requires disposal.
  - Dead or dying trees may fall onto the roadway during a storm.
  - Herbicide drift will occur.
    - Keep detailed records of product applications.
    - Document any concerns in advance and subsequent complaints with photographs.
    - Make timely personal contact with landowners.
- Because of cost of liability from herbicide drift and worker injury, the wide spread use of foliar sprays may be self limiting.

**Practical applications of foliar sprays:**

- Choose higher tech, selective herbicides.
- Restrict use to low volume roads.
- Use to control invading exotics.
- Use to selectively treat resprouting after an area has been mechanically cut.

**Iowa Summary**

- 67 counties have a foliar spray program.
  - *It should be noted that 32 counties have no foliar spray program.*
- The use of foliar spray comprises about 29% of their brush control effort.
- Overall Satisfaction (Low) 1..2..3..4..5..6 (High)
  - Average: 4.3
- Almost 63% of those surveyed were aware of significant concerns about using chemical control in their county?
  - Of those noting a concern, 87% have since altered their spraying efforts.

- Major concerns about chemical control:
  - 56% Sensitive nontarget areas will be affected.
    - drift
    - over spray
    - soil leaching
    - surface runoff
    - the non-specific nature' of most herbicides
  - 22% Spraying is bad for public relations.
    - Most of the concern is for the people who “go bananas” when they see someone out spraying.
    - Offsetting that is the opinion of farmers who regularly use herbicide and want all ditch weeds dead right now.
  - 22% Administrative complaints.
    - Chemicals are expensive
    - Some employees are reluctant to spray; some have obtained a doctor’s release.
    - Equipment is expensive to maintain.
    - Certification is a hassle & expense; Many employees are not stellar students.
    - Reporting requirements are a hassle & expense.
- Changes to foliar programs as a result of concern about chemical control.
  - 21 counties intend to not spray around sensitive areas and be very careful around crops.
  - 10 counties avoid herbicide drift by staying within the prescribed application conditions for temperature and wind speed.
  - 7 counties discontinued their spray program except for noxious weeds.
    - 2 counties are slowly resuming with a goal of zero public complaints.
  - 6 counties cite their rejection of blanket spraying in favor of spot spraying as the only accommodation they have made so far.
  - 5 counties have changed the chemicals or equipment that they use.
  - 8 counties have made no accommodations.
    - Several managers remark that they would like to make changes but see no viable alternative to spraying.

*“If there is a problem, it is often not the product but the misapplication of a product.”*

– Jon Steege  
Roadside Manager  
Fayette County

**Table 1.**

<b>Commercial Product</b>	<b>Herbicide nomenclature.</b>	<b>Generic Chemical Name</b>
2,4-D		
2,4-DLV4		2,4-D
Arsenal		imazapyr
Banvel		dicamba
Crossbow		triclopyr + 2,4-D
DPD Ester		2,4-D
Escort		metsulfuron-methyl
Escort XP		metsulfuron-methyl
Garlon 3A		triclopyr
Garlon 4		triclopyr
Hi-Dep		2,4-D
Krenite S		fosamine ammonium
LV 6		2,4-D
Pathfinder II		triclopyr
Pathway		picloram
Patron 170		2,4-D
Phenoxy		2,4-D
Remedy		triclopyr
Stalker		imazapyr
Tordon 101M		picloram
Tordon 22K		picloram
Tordon K		picloram
Weedone LV6 EC		2,4-D

**Table 2.****Foliar sprays used in Iowa.**

<b>County Tally</b>	<b>Product(s)</b>
<i>Fosamine ammonium, triclopyr and 2,4-D are the most common foliar control products used in Iowa.</i>	
15	fosamine ammonium
14	triclopyr
13	triclopyr + 2,4-D
1	fosamine ammonium + triclopyr + 2,4-D
10	2,4-D
4	metsulfuron-methyl
3	picloram
<i>Metsulfuron-methyl becomes significant as a piggybacked product.</i>	
6	metsulfuron-methyl + 2,4-D
4	metsulfuron-methyl + fosamine ammonium
3	metsulfuron-methyl + triclopyr
2	metsulfuron-methyl + picloram
<i>Imazapyr is occasionally added to a metsulfuron-methyl + x triad.</i>	
3	metsulfuron-methyl+ picloram + imazapyr
1	metsulfuron-methyl + fosamine ammonium + imazapyr
<i>2,4-D provides broad-based support for other products when used in combination.</i>	
1	metsulfuron-methyl + Triclopyr + 2,4-D
2	picloram + 2,4-D
1	dicamba + 2,4-D

**Table 3.**

<b>Foliar spray product solutions to persistent trees and brush.</b>		
<b>Species</b>	<b>Chem-Trol/VMS</b>	<b>UAP/Timberland</b>
Boxelder	Escort 2 oz Tordon K	Tordon K Garlon Escort XP
Chinese Elm	Escort 2 oz Garlon 4 Krenite Tordon K	Garlon Dicamba Escort XP Tordon 101
Cottonwood	Escort 2 oz Garlon 4 Krenite	Escort XP Garlon Krenite Dicamba/Vanquish Patron 170
Eastern Red Cedar	Escort 3 oz Tordon K w/ non-ionic surfactant	Escort XP Tordon K
Green Ash	Krenite Escort	Krenite plus Tordon K Escort XP Garlon
Locust	Tordon K	Tordon K/Tordon 101 2,4-D & Dicamba
Maple	Escort 2 oz Krenite Tordon K Garlon 4	Tordon K Arsenal Krenite plus Tordon or Escort Garlon plus Tordon or Escort
Mulberry	Escort 2 oz Garlon 3A Krenite	Tordon K Escort XP Stalker/Arsenal Krenite Garlon not effective

**Table 3. (continued)**

<b>Foliar spray product solutions to persistent trees and brush.</b>		
<b>Species</b>	<b>Chem-Trol/VMS</b>	<b>UAP/Timberland</b>
Pine	Arsenal w/ Garlon or Tordon	Tordon K/Tordon 101 Krenite Escort XP Garlon Dicamba/Vanquish
Plum	Escort 2 oz Garlon Tordon Krenite	Escort XP Garlon Tordon K Krenite
Sumac	Escort Arsenal	Escort XP Garlon Tordon K/Tordon 101 Patron 170
Willow	Escort 1 oz Garlon 4 Krenite	2, 4-D Same as cottonwood

Note: Some of the above recommendations vary depending on whether sensitive plants are growing adjacent or below the target plant.

**Sources**

Lyle Christensen  
Chem-Trol/VMS  
1924 Fuller Road  
West Des Moines, IA 50265  
515 223-0202

Jon Storr  
UAP/Timberland  
5482-2 Longview Court  
Johnstown, IA 50131  
515 986-5868

*“In our county, willow patches are most troublesome, but there are also bad miles of brush with every kind of tree and weed.”*

– Bud Butcher  
Road Foreman  
Floyd County

## 4.4 Basal Bark Spray



(D.J. Silviculture)

Basal bark spray can be applied using backpack sprayers. Care should be taken to avoid over spray. Despite the time it takes to treat single trees, this method is very effective on many otherwise sensitive areas.

### Application

- Crews using backpack or handheld sprayers treat the stem of a target tree with herbicide.
- Herbicide is generally applied over several feet of basal trunk all around the stem circumference and root crown.
- The amount of herbicide applied is proportional to bark thickness and trunk diameter.
  - Herbicide is often sprayed directly onto smaller trunks and thick bark trees.
  - Larger trees may require notching the bark before applying herbicide to the wound.
  - With Garlon 4, basal bark spray is effective on trees up to 10 in. diameter breast height (dbh). (The label limits application to 6 inches dbh.)
  - Only enough herbicide is used to wet the bark, no need for runoff or pooling.
- An excellent integrating tool.
- Good for sensitive and high traffic areas. Very low profile.
- Slow. Trees must be treated carefully.
- Good for killing regrowth..
- May be used all year, though some think this may be ineffective in spring when trees are sapping up.

*“Basal bark [herbicide application] is probably the most underused, best way of controlling unwanted vegetation.”*

– Jon Steege  
Roadside Manager  
Fayette County

### Issues

- A handy method for prairie restorations & remnants.
  - Watch out for over spray.
  - Beware of products that may leak out the roots of plants and kill adjacent plants (the “ring of death”).
- Unfortunately, the basal bark method is too time consuming for many counties, taking too much time to treat too few trees.

### Iowa Summary

- Only 21 counties report the use of basal bark spray as a brush control method.
- Basal bark spray comprises an average 6.5% of their brush control effort
- Overall Satisfaction (Low) 1..2..3..4..5..6 (High)
  - average 4.3

**Table 4.**

<b>Basal bark products used in Iowa.</b>	
<b>County Tally</b>	<b>Product(s)</b>
<i>Triclopyr is the most common basal bark product used in Iowa.</i>	
11	triclopyr
4	triclopyr + 2,4-D
1	triclopyr + imazapyr
3	picloram
1	2,4-D
1	glysophate
1	dicamba
1	(metsulfuron-methyl + imazapyr + watersoft + riverside silken + triclopyr)®

®Taylor County purchases this mixture from a MO utility

**Table 5.**

<b>Basal bark product solutions to persistent trees and brush.</b>		
<b>Species</b>	<b>Product</b>	<b>Reporting County</b>
Black Locust	Garlon 4	Iowa
Boxelder	Pathfinder II, Garlon 4	Winneshiek
Chinese Elm	Pathfinder II, Garlon 4	Iowa, Winneshiek
Cottonwood	Garlon 4 (+ Stalker optional)	Iowa, Dickinson
Eastern Red Cedar	<i>poor</i> : Pathfinder II, Garlon 4	Iowa, Winneshiek
Oak	Garlon 4	Iowa
Poplar	Garlon 4	Iowa
Sumac	Pathfinder II, Garlon 4	Winneshiek
Willow	Stalker + Garlon 4	Dickinson

## 4.5 Cut Stump Treatment



(Greg Schmitt)

Most deciduous trees vigorously resprout from a cut stump if not chemically treated.

*“We have a motto in our county about not treating cut stumps: Kill one and ten come to the funeral.”*

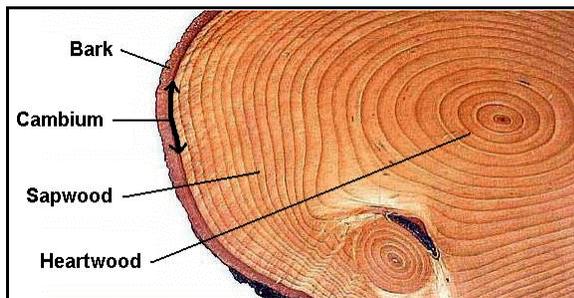
– Chris Snyder, Roadside Manager, Mahaska County

### Application

- The stump surface of freshly cut deciduous trees should be treated to reduce or eliminate resprouting.
- Some sprouts originate from buds around the ground line of the stump while others occur from the lateral roots of cut trees.
- Sprouts have the potential to develop rapidly in height if fed by a large existing root system.
- Sprouting often results in multiple stemmed trees.

### Method

- Cut stumps as low as possible so that they do not remain as hazards in the clear zone.
- Once cut, a systemic herbicide is applied to the fresh wood surface.
- Always follow label directions.
- Treat cut surfaces as soon as possible.
  - Once wood is cut, living cells near the surface begin to die and absorption of the treatment is reduced.
  - To insure that most cut stumps are treated promptly, some counties designate a single employee to follow a chain saw crew just to treat cut stumps.



- A ring of herbicide should be applied to the perimeter of the stump surface soaking the bark, cambium and outer sapwood.
  - Heartwood in the middle of the stump is non-living tissue and need not be treated.
  - For small stumps, treat the entire stump since the outer edge is too small to treat separately.

- For products such as Pathfinder, it is also necessary to soak the sides of the stump down to the root collar but not to the point of runoff.
- Cut stump treatments are not recommended in late winter when sap is “rising,” since the stump may exude sap, flushing the herbicide from the cut surface.
  - Pathfinder II may be applied any time of the year.
- Check the label for the best time of year to apply a product.

**Issues**

- For areas with steep rock cuts, cut stumps may be out of reach without repelling equipment.
- If herbicides are not used, sprouting can be expected, and frequent cutting will be required until the food supply in the roots is exhausted.
- These herbicides have a potential to damage adjacent native, crop and ornamental plants through volatilization and/or soil persistence of their active ingredients.

**Iowa Summary**

1. Do you treat cut stumps with herbicide?

- yes 96 counties
- no 3 counties

2. Of those 96 counties: What percentage stumps do you think your crews are able to treat?

- average 87.1% ± 1.8%
- median 90%
- range 1-100%

**Table 6.**

**Cut stump products used in Iowa.**

**County**

**Tally Product**

*Picloram + 2,4-D is the most common cut stump formulation used in Iowa.*

91	picloram + 2,4-D
13	triclopyr
1	2,4-D + 2(2,4-D)P
1	dicamba
1	tebuthiuron
1	unsure

#### **4.6 Commonly used herbicides.**

- The following is a compilation of chemical products reported by our survey.
- Each page is a thumbnail sketch of a generic chemical.
- Information is not intended as a substitute for label information or material safety data sheets.
- Products
  - 2,4-D
  - dicamba
  - fosamine ammonium
  - glyphosate
  - imazapyr
  - metsulfuron-methyl
  - picloram
  - triclopyr

## 2,4-D

(Pronounced: two, four, DEE)

- There are many forms (esters, amines, salts) of 2,4-D.

### Note

This summary is not intended as a substitute for specific product labels or material safety data sheets.

### Trade Names; Chemical Names

- 2,4-D LV4 (Agriliance)  
isooctyl 2-ethylhexyl ester of 2,4-dichloro-phenoxy acetic acid
  - Phenoxy 088 (Agriliance)  
2,4-dichlorophenoxyacetic acid  
2,4-dichlorophenoxyacetic acid butoxyethyl ester
  - Hi-Dep IVM (PBI/Gordon)  
dimethylamine salt of 2,4-dichlorophenoxyacetic acid  
diethanolamine salt of 2,4-dichlorophenoxyacetic acid
  - LV 6 (NuFarm/Riverdale)  
isooctyl (2-ethylhexyl) ester of 2,4-dichlorophenoxyacetic acid
  - Patron 170\* (NuFarm/Riverdale)  
2,4-dichlorophenoxyacetic acid  
2-(2,4-dichlorophenoxy) propionic acid
  - DPD Ester Brush Killer\* (Platte)  
isooctyl (2-ethylhexyl) ester of 2,4-dichlorophenoxyacetic acid  
isooctyl (2-ethylhexyl) ester of 2-(2,4-dichlorophenoxy) propionic acid
  - Weedone LV 6 EC (NuFarm/Riverdale)  
2,4-dichlorophenoxyacetic acid, isooctyl ester
- \* Also contains isooctyl (2-ethylhexyl) ester of 2-(2,4-dichlorophenoxy) propionic acid

### Chemistry

- Chemical Name: 2,4-dichlorophenoxy acetic acid
- Herbicide Family: phenoxy (auxin growth regulators)
- Commonly used alone, or in combination with triclopyr, metsulfuron-methyl, picloram, fosamine ammonium and/or dicamba.
- The ester form readily volatilizes when air temperatures exceed 80°F.

### Uses

- Kills many types of herbaceous broadleaf and woody plants.
- Used in cultivated agriculture, pasture and rangeland applications, forest management, rights-of-way, lawns, gardens, and for the control of aquatic vegetation.

### Herbicide Properties

- Mimics the plant hormone auxin, causing uncontrolled growth and eventual death in susceptible plants.
- Uptake of the compound is through leaves, stems and roots

### Environmental Cautions

- Slightly toxic to birds.
- Some formulations of 2,4-D are highly toxic to fish.
- Toxic to honeybees.
- Average soil half life 10 days.

- Leaches into surface and groundwater.
- Many formulations are highly volatile and drift readily. Low volatility (LV) esters have been developed to help reduce this problem.

### **Safety Concerns**

- Readily absorbed through the skin and lungs.
- Has produced serious eye and skin irritation among agricultural workers.
- Prolonged breathing of this product causes coughing, burning, dizziness, and temporary loss of muscle coordination.
- Symptoms of poisoning include fatigue, weakness and perhaps nausea.
- Prolonged exposure can cause liver damage.
- Causes reproductive disorders at moderate doses in animals.
- Linked to birth defects.
- May be carcinogenic.

### **Issues**

- Although recently manufactured 2,4-D technical acids have consistently been free of dioxin contamination, the amine and ester products may have measurable levels of some forms of dioxin. Dioxin levels are not thought to be biologically significant.

### **Vendors**

Agriliance

P.O. Box 64089

St. Paul, MN 55164

Telephone 800 720-3639

Emergency 877 424-7452

NuFarm/Riverdale Americas Inc

1333 Burr Ridge Parkway

Suite 125A

Burr Ridge, IL 60527-0866

Telephone 800-345-3330

Emergency

Human Poisoning 800 345-3330:

Conrad Harwell, Russ Sawyer;

hours 8-5 CST M-F

Spills 800 424-9300

PBI/Gordon

1217 West 12th Street

Kansas City, MO 64101

Telephone 800 821-7925

Emergency

Human Poisoning 877-800-5556

Animal Poisoning 800 345-4735

Spills 800 424-9300

Platte Chemical Company

419 18<sup>th</sup> Street

Greeley, CO 80631

Telephone 970-356-4400; hours 8-5 MST

Emergency 800 228-5635 extension 136

### **References**

[CDMS (1)] Crop Data Management Systems. July 2002. 2,4-D LV4; Phenoxy 088 [labels; msds]. In: Agriculture/crop protection for Agriliance, LLC. Marysville, CA: CDMS. <<http://www.cdms.net/manuf/mprod.asp?mp=150>>. Accessed 2002 Jul 9.

- [CDMS (2)] Crop Data Management Systems. July 2002. Weedone LV6 EC [label; msds]. In: Agriculture/crop protection for NuFarm Americas Inc. (Plus Agtrol products). CDMS: Marysville, CA. <<http://www.cdms.net/manuf/mprod.asp?mp=171&lc=1>>. Accessed 2002 Jul 9.
- [CDMS (3)] Crop Data Management Systems. July 2002. LV 6 [label; msds]. In: Agriculture/crop protection for Wilbur-Ellis Company. CDMS: Marysville, CA. <<http://www.cdms.net/manuf/mprod.asp?mp=36&lc=1>>. Accessed 2002 Jul 9.
- PBI/Gordon. 2002. Hi-Dep IVM [label; msds]. Kansas City, MO: PBI/Gordon. <<http://www.pbigordon.com/agricultural.htm>>. Accessed 2002 Jul 10.
- [PMEP] Pesticide Management Education Program. 1993. 2,4-D. In: Extension toxicology network: 2,4-d to captan. Cornell University: Ithaca, NY. <<http://pmep.cce.cornell.edu/profiles/extoxnet/24d-captan/index.html>>. Accessed 2002 Jul 9.
- Riverdale. 2002. Patron 170 [label; msds]. NuFarm/Riverdale: Burr Ridge, IL. <<http://www.riverdalecc.com/labelsmsds.htm>>. Accessed 2002 Jul 9.
- Tu M, Hurd C, Randall JM. April 2001. Weed control methods handbook. In: The Nature Conservancy: invasives on the web. Davis, CA: The Nature Conservancy Wildland Invasives Species Team: University of California. <<http://tncweeds.ucdavis.edu/handbook.html>>. Accessed 2002 Jul 15.

## Dicamba

(Pronounced: dye-CAM-bah)

### Trade Names

- Banvel
- Vanquish

### Chemistry

- Chemical Name: dimethyl or diglycol amine salt of dicamba (3,6-dichloro-o-anisic acid).
- Herbicide Family: benzoic acid (auxin growth regulator)
- Dicamba is only occasionally used to control roadside brush in Iowa. As a foliar spray, it is usually combined with 2,4-D.
- This compound readily volatilizes when air temperatures exceed 80°F.

### Uses

- It can be applied to the leaves or to the soil.
- Dicamba controls broadleaf weeds in grain crops and grasslands, and it is used to control brush and bracken in pastures and roadsides.

### Herbicide Properties

- Dicamba is a systemic herbicide that is rapidly taken up by the leaves and roots of plants.
- It mimics the plant hormone auxin, causing uncontrolled growth and eventual death in susceptible plants.
- It typically attacks the tips of growing shoots.
- Resistant plants eliminate dicamba by root and leaf exudation, and by metabolism.

### Environmental Cautions

- If used properly, dicamba is only slightly toxic to birds, mammals and aquatic organisms.
- It leaches readily from the soil into surface and ground water.
- Dicamba has an average soil half-life of 1-4 weeks.
- Most applications will have decomposed in the soil after a year.

### Safety Concerns

- Can cause severe and permanent injury to the eyes.
- In some individuals this product is a skin sensitizer.
- Inhalation can cause irritation of the linings of the nasal passages and the lungs, and loss of voice.
- Symptoms of poisoning include loss of appetite, vomiting, muscle weakness, slowed heart rate, shortness of breath, central nervous system effects (victim may become excited or depressed), benzoic acid in the urine, incontinence, cyanosis, and exhaustion following repeated muscle spasms.
- Most individuals who have survived severe poisoning from dicamba have recovered within 2 to 3 days with no permanent effects.
- Dicamba is suspected of causing birth defects.

### Note

This summary is not intended as a substitute for specific product labels or material safety data sheets.

**Vendor**

Micro Flo

P.O. Box 772099

Memphis, TN 38117

Telephone 800 451-8461

Emergency

Human Poisoning 800 900-4044 (Poison Control Center)

Animal Poisoning 800 345-4735 (ASPCA, animal health)

Spills 800 424-9300 (Chemtrec)

**References**

[CDMS] Crop Data Management Systems. July 2002. Banvel [label; msds]. In: Agriculture/crop protection for Micro Flo Company LLC. Marysville, CA: CDMS. <<http://www.cdms.net/manuf/mprod.asp?mp=25>>. Accessed 2002 Jul 10.

[PMEP] Pesticide Management Education Program. 1993. Dicamba. In: Extension toxicology network: carbaryl to dicrotophos. Ithaca, NY: Cornell University. <<http://pmep.cce.cornell.edu/profiles/extoxnet/carbaryl-dicrotophos/index.html>>. Accessed 2002 Jul 9.

## Fosamine Ammonium

(Pronounced: FOSS-ah-mean, ah-MOAN-ee-um)

### Trade Names

- Krenite
- Krenite S

### Chemistry

- Chemical Name: ammonium salt of fosamine [ethyl hydrogen (aminocarbonyl) phosphonate]
- Herbicide Family: none generally recognized.
- Commonly used alone, or sometimes in formulations with 2,4-D, imazapyr, metasulfuron-methyl and/or triclopyr.

### Uses

- Used to suppress many woody plant species.
- Typically applied in late summer or early fall.

### Herbicide Properties

- Susceptible treated plants normally fail to refoliate during the growing season following treatment and subsequently die.
- Its exact mode of action is not understood.

### Environmental Cautions:

- Only slightly toxic to birds, mammals and aquatic life.
- Fast disappearance rate in soil; half-life of about 7-10 days.
- Tends not to leach from soil because of its short half-life.

### Safety Concerns

- Do not get in eyes, skin, or on clothing. Avoid breathing vapors. Causes moderate eye, skin, nose, throat, and lung irritation.
- Ingestion of high doses may include nonspecific discomfort, such as nausea, headache, or weakness.

### Vendor

DuPont

1007 Market Street

Wilmington, DE 19898

Telephone 800-441-7515

Emergency 800-441-3637

### References

DuPont. 2002. Krenite S [label; msds]. Wilmington, DE: DuPont.

<[http://www.dupont.com/ag/labelmsds\\_search.html](http://www.dupont.com/ag/labelmsds_search.html)>. Accessed 2002 Jul 11.

[PMEP] Pesticide Management Education Program. Fosamine ammonium (Krenite) herbicide

### Note

This summary is not intended as a substitute for specific product labels or material safety data sheets.

profile 2/85. In: Fosamine ammonium (Krenite). PMEP: Cornell University: Ithaca, NY. <<http://pmep.cce.cornell.edu/profiles/herb-growthreg/fatty-alcohol-monuron/fosamine-ammonium/index.html>>. Accessed 2002 Jul 9.

Tu M, Hurd C, Randall JM. April 2001. Weed control methods handbook. In: The Nature Conservancy: invasives on the web. The Nature Conservancy Wildland Invasives Species Team: University of California, Davis, CA. <<http://tncweeds.ucdavis.edu/handbook.html>>. Accessed 2002 Jul 15.

## **Glyphosate**

(Pronounced: GLY-foe-zate)

- There are many forms of glyphosate.

### **Trade Names**

- RoundUp Original
- RoundUp UltraMax

### **Chemistry**

- Chemical Name: N-(phosphonomethyl) glycine, in the form of its isopropylamine salt
- Herbicide Family: aromatic amino acid inhibitor
- Infrequently used for basal bark and cut stump treatments.

### **Uses**

- A broad-spectrum, non-selective systemic herbicide.
- It is useful on many annual and perennial plants including grasses, sedges, broad-leaved weeds and woody plants.
- Glyphosate is rapidly inactivated in the soil, so its application is limited to plant material.
- Glyphosate tolerant cultivars of soybeans (RoundUp Ready), corn, and other crops are currently being marketed.

### **Herbicide Properties**

- Glyphosate kills plants by inhibiting the activity of an enzyme that produces the amino acids tyrosine, tryptophan, and phenylalanine.
- Without these amino acids, plants are unable to produce proteins that link primary and secondary metabolism.
- Symptoms include yellowing of new growth and death of treated plants in days to weeks.

### **Environmental Cautions**

- Glyphosate is strongly adsorbed to soil particles, which prevents it from excessive leaching or from being taken-up from the soil by non-target plants.
- Average soil half-life 2 months.
- Glyphosate of low toxicity to fauna; Rodeo registered for aquatic use.
- Surfactants used in some formulations are highly toxic to aquatic organisms.

### **Chemical Hazard**

- Explosion potential.
  - Do not mix, store, or apply imazapyr or spray solutions of imazapyr in unlined steel (except stainless steel) containers or spray tanks.
  - Reaction to steel produces hydrogen gas.

#### **Note**

This summary is not intended as a substitute for specific product labels or material safety data sheets.

### **Safety Concerns**

- Causes moderate eye irritation
- Avoid contact with skin, eyes or clothing.
- Avoid breathing spray mist.
- Generally does not cause skin or respiratory irritation if used as directed.

### **Vendor**

Monsanto Company  
800 N. Lindbergh Blvd.  
St. Louis, MO 63167  
Telephone 800 332-3111  
Emergency Day or Night 314 694-4000 (collect calls accepted)  
Spills 800 424-9300

### **References**

- Monsanto. 2002. RoundUp Original; RoundUp UltraMax [labels; msds]. St. Louis, MO: Monsanto. <[http://www.farmsource.com/Product\\_Info/MSDSandLabels.asp](http://www.farmsource.com/Product_Info/MSDSandLabels.asp)>. Accessed 2002 Jul 12.
- [PMEP] Pesticide Management Education Program. 1985. Glyphosate. In: Extension toxicology network: dienochlor to glyphosate. Ithaca, NY: Cornell University. <<http://pmep.cce.cornell.edu/profiles/extoxnet/dienochlor-glyphosate/index.html>>. Accessed 2002 Jul 9.
- Tu M, Hurd C, Randall JM. April 2001. Weed control methods handbook. In: The Nature Conservancy: invasives on the web. Davis, CA: The Nature Conservancy Wildland Invasives Species Team: University of California. <<http://tncweeds.ucdavis.edu/handbook.html>>. Accessed 2002 Jul 15.

## **Imazapyr**

(Pronounced: eh-MAZZ-appear)

### **Trade Names**

- Arsenal
- Stalker

### **Chemistry**

- Chemical Name: isopropylamine of imazapyr  
2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1-H-imidazol-2-yl]-3-pyridinecarboxylic acid
- Herbicide Family: imidazolinone (branched chain amino acid inhibitor)
- Infrequently used, only in combination with metsulfuron-methyl and either picloram or fosamine ammonium.

### **Uses**

- A non-selective herbicide used for the control of a broad range of weeds including annual and perennial grasses, broadleaf herbs and woody species.
- Used in non-crop areas where bare ground is desired: railways, roadsides, industrial sites, power substations.
- Usually applied to post emergent vegetation.

### **Herbicide Properties**

- Imazapyr is a systemic herbicide that is absorbed through leaves and roots.
- The product prevents the production of the amino acids valine, leucine, and isoleucine.
- Once the levels of these amino acids decrease, protein synthesis slows down and growth stops.
- Shoot tips die first.
- Mature, green tissue is not as rapidly affected.
- Plant death often occurs after several weeks.

### **Environmental Cautions**

- May leak from the roots of target brush to affect adjacent vegetation.
- May persist in the soil for long periods. American Cyanamid reported that the half-life of imazapyr in soils that ranged from seven months to more than seven years, depending on soil type, temperature, and soil moisture.
- Has moderate leaching potential.
- Soil adsorption increases with decreasing pH and soil moisture.

### **Chemical Hazard**

- Do not mix, store, or apply imazapyr or spray solutions of imazapyr in unlined steel (except stainless steel) containers or spray tanks.

#### **Note**

This summary is not intended as a substitute for specific product labels or material safety data sheets.

### **Safety Concerns**

- Avoid contact with skin, eyes or clothing.
- Avoid breathing spray mist.
- Generally does not cause skin, eye, or respiratory irritation.

### **Vendor**

BASF (previously American Cyanamid)  
Agricultural Products Group  
P.O. Box 13528  
Research Triangle Park, NC 27709  
Telephone 800 327-4645  
Emergency 800 832-4357  
Spills 800 424-9300

### **References**

- BASF. 2002. Arsenal; Stalker [labels; msds]. Research Triangle Park, NC: BASF.  
<<http://www.cyanamidspd.com/default.asp?page=vmg%7Clabelsmsds>>. Accessed 2002 Jul 14.
- BASF/True North. 2001. Arsenal technical fact sheet. Research Triangle Park, NC: BASF.  
<<http://www.truenorthspecialty.com/english/Products/arsenalTech.pdf>>. Accessed 2002 Jul 14.
- [PMEP] Pesticide Management Education Program. 1985. Imazapyr (Arsenal) herbicide profile 9/85. In: Imazapyr (arsenal). Ithaca, NY: PMEP: Cornell University.  
<<http://pmep.cce.cornell.edu/profiles/herb-growthreg/fatty-alcohol-monuron/imazapyr/index.html>>. Accessed 2002 Jul 9.
- Tu M, Hurd C, Randall JM. April 2001. Weed control methods handbook. In: The Nature Conservancy: invasives on the web. Davis, CA: The Nature Conservancy Wildland Invasives Species Team: University of California.  
<<http://tncweeds.ucdavis.edu/handbook.html>>. Accessed 2002 Jul 15.

## **Metsulfuron-methyl**

(Pronounced: met-sull-FEWER-on, METH-ell)

### **Trade Names**

- Escort
- Escort XP

### **Chemistry**

- Chemical Name: Methyl 2-[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]-carbonyl]amino]sulfonyl]benzoate
- Herbicide Family: sulfonyleurea (amino acid inhibitor)
- Sometimes used alone, but more often used in combination with 2,4-D, fosamine ammonium, triclopyr, picloram and/or imazapyr.

### **Uses**

- Used to control weeds and brush and some annual grass in non-crop areas, and conifer plantations.
- The product is typically applied to foliage after emergence or dormancy break.

### **Herbicide Properties**

- This is a systemic compound with foliar and soil activity, and it works rapidly after it is taken up by the plant.
- It works by inhibiting cell division in the shoots and roots of the plant, and it is biologically active at low use rates.
- It does not persist in vegetation and is broken down to non-herbicidal products in tolerant plants.

### **Environmental Cautions**

- Half-life estimates in soil range from 14 - 180 days, with a 30 day mean.
- The compound degrades faster under warm, moist, acidic conditions and tends to be mobile in alkaline soils.
- Because it is residual in soils, it is necessary to allow ample time for the chemical to break down before planting certain crops (i.e. 22 months for sunflowers, flax, corn, or safflower, and 10 months before planting sorghum).
- Half-life measurements in water are similar to those of soil, but few problems are reported for aquatic life exposed to this compound.

### **Safety Concerns**

- Causes eye irritation with tearing, pain or blurred vision.
- Repeated exposure may cause skin irritation.
- Avoid contact with skin, eyes or clothing.
- Avoid breathing dust or spray mist.

### **Note**

This summary is not intended as a substitute for specific product labels or material safety data sheets.

**Vendor**

DuPont

1007 Market Street

Wilmington, DE 19898

Telephone 800 441-7515

Emergency 800 441-3637

Transport 800 424-9300

**References**

DuPont. 2002. Escort; Escort XP [labels; msds]. Wilmington, DE: DuPont.

<[http://www.dupont.com/ag/labelmsds\\_search.html](http://www.dupont.com/ag/labelmsds_search.html)>. Accessed 2002 Jul 11.

PMEP (Pesticide Management Education Program). 1993. Metsulfuron methyl. In: Extension toxicology network: metiram to propoxur. Ithaca, NY: Cornell University.

<<http://pmep.cce.cornell.edu/profiles/extoxnet/metiram-propoxur/index.html>>.

Accessed 2002 Jul 11.

## Picloram

(Pronounced: PICK-lore-am)

### Trade Names

- Tordon K
- Tordon 22K
- Tordon 101M
- Tordon RTU\*
- Pathway\*

\*also contains 2,4-D, triisopropanolamine salt

### Note

This summary is not intended as a substitute for specific product labels or material safety data sheets.

### Chemistry

- Chemical Name: 4-amino-3,5,6-trichloro-2-pyridinecarboxylic acid, potassium salt.
- Herbicide Family: pyridine (picolinic acid) (auxin growth regulator).
- As a foliar spray, picloram is sometimes used alone, or more commonly in combination with metsulfuron-methyl, imazapyr and/or 2,4-D.
- Tordon RTU and Pathway are commonly used to treat cut stumps.

### Restrictions

- Tordon K, 22K and 101M are Restricted Use Pesticides (RUP).

### Uses

- A systemic herbicide used for general woody plant control.
- Controls a wide range of broad-leaved weeds excepting mustards (crucifers).
- Most grasses are resistant to picloram.
- For preemergence control, this compound is typically applied in late winter or early spring.
- For grass areas excellent results can be achieved with treatment coinciding with periods of vigorous growth.

### Herbicide Properties

- Systemic, readily absorbed by plant roots, less so by the foliage.
- Mimics the plant hormone auxin, causing uncontrolled growth and eventual death in susceptible plants.
- It remains stable and intact in plants.

### Environmental Cautions

- Not highly toxic to birds, mammals, and aquatic species.
- Because of its persistence, chronic exposure to wildlife can cause weight loss and liver damage.
- Average soil half-life 90 days; residual up to 2 years.
- Mobile in the soil.
- Leaches into groundwater.
- Concentrations in runoff often adequate to prevent the growth of non-target terrestrial and aquatic plants. Do not use near irrigation areas.

### **Safety Concerns**

- Mildly toxic on the skin.
- Some can cause severe eye damage if splashed into the eyes.
- Some formulations are highly toxic if inhaled.
- A possible symptom from massive intoxication would be nausea.

### **Vendor**

Dow AgroSciences LLC  
9330 Zionsville Road  
Indianapolis, IN 46268  
Telephone: 800 352-6776  
Emergency: 800 992-5994 and follow options.

### **References**

- Dow AgroSciences. 2002. Tordon K, 22K, RTU; Pathway [labels; msds]. Indianapolis, IN: Dow. <[http://www.dowagro.com/label/product\\_select.asp](http://www.dowagro.com/label/product_select.asp)>. Accessed 2002 Jul 9.
- Nomix-Chipmen. 1999. Tordon 22 selective residual herbicide [labels; msds]. Bristol, England:  
Nomix-Chipmen. <<http://www.nomix-chipman.co.uk/profess/technical/index.htm>>. Accessed 2002 Jul 9.
- [PMEP] Pesticide Management Education Program. 1993. Picloram. In: Extension toxicology network: metiram to propoxur. Ithaca, NY: Cornell University. <<http://pmep.cce.cornell.edu/profiles/extoxnet/metiram-propoxur/picloram-ext.html>>. Accessed 2002 Jul 9.
- Tu M, Hurd C, Randall JM. April 2001. Weed control methods handbook. In: The Nature Conservancy: invasives on the web. Davis, CA: The Nature Conservancy Wildland Invasives Species Team: University of California. <<http://tncweeds.ucdavis.edu/handbook.html>>. Accessed 2002 Jul 15.

## Triclopyr

(Pronounced: TRI-clo-peer)

### Trade Names

- Garlon 3A
- Garlon 4
- Pathfinder II
- Remedy
- Crossbow\*

\*also contains 2,4-D

### Note

This summary is not intended as a substitute for specific product labels or material safety data sheets.

### Chemistry

- Chemical Name: [(3,5,6-trichloro-2-pyridinyl)oxy] acetic acid.
- Herbicide Family: pyridine (picolinic acid) (auxin growth regulator).
- Commonly used alone, or sometimes in combination with 2,4-D, fosamine ammonium, and/or metsulfuron-methyl.
- This compound readily volatilizes when air temperatures exceed 80°F.

### Uses

- A selective systemic herbicide used for control of woody and broadleaf plants along rights-of-way, in forests, on industrial lands and on grasslands.
- Typically applied when woody plants and broadleaf herbs are actively growing. For hard to control species, higher concentrations may be needed.

### Herbicide Properties

- Triclopyr is readily translocated throughout a plant after being taken up by either roots or the foliage.
- Mimics the plant hormone auxin, causing uncontrolled growth and eventual death in susceptible plants.
- Excessive cell growth in plant may lead to plugging of xylem tissue.

### Environmental Cautions

- To avoid damage to oaks and walnuts, maintain an application distance of twice the canopy diameter. The roots of these trees often share nutrients with other plant roots via the connections of specialized fungi (tripartite nutrition).
- Slightly toxic to birds.
- Some formulations are highly toxic to aquatic organisms.
- Triclopyr has the potential to be mobile in the soil.
- Average soil half-life is 30 days. Longer half-lives occur in cold or arid conditions.
- The estimated half-life in above ground drying foliage (as in a forest canopy) is two to three months.

### **Safety Concerns**

- Use may cause slight, temporary eye irritation.
- Prolonged exposure may cause allergic reaction.
- Excessive exposure may cause nose and throat irritation.
- Kerosene (contained in some formulations) may cause central nervous system effects.
- Combustible.

### **Issues**

- A similar product 2,4,5-T has been banned in the United States because of dioxin impurities. Triclopyr is thought to be free of dioxin.

### **Vendor**

Dow AgroSciences LLC  
9330 Zionsville Road  
Indianapolis, IN 46268  
Telephone: 800 352-6776  
Emergency 800-992-5994 (listen to options)

### **References**

- Dow AgroSciences. 2002. Garlon 3A, 4; Pathfinder II; Remedy; Crossbow [labels; msds]. Indianapolis, IN: Dow. <[http://www.dowagro.com/label/product\\_select.asp](http://www.dowagro.com/label/product_select.asp)>. Accessed 2002 Jul 10.
- [PMEP] Pesticide Management Education Program. 1993. Triclopyr. In: extension toxicology network: pyrethrins to ziram. Ithaca, NY: Cornell University. <<http://pmep.cce.cornell.edu/profiles/extoxnet/pyrethrins-ziram/triclopyr-ext.html>>. Accessed 2002 Jul 10.
- Ross MA, Childs DJ. 1996. Herbicide mode of action summary. West Lafayette, IN: Purdue, University. Cooperative Extension Service publication nr WS-23. <http://www.agcom.purdue.edu/AgCom/Pubs/WS/WS-23.html>. Accessed 2002 Jul 10.
- Tu M, Hurd C, Randall JM. April 2001. Weed control methods handbook. In: The Nature Conservancy: invasives on the web. Davis, CA: The Nature Conservancy Wildland Invasives Species Team: University of California. <<http://tncweeds.ucdavis.edu/handbook.html>>. Accessed 2002 Jul 15.

## SECTION 5 – PRESCRIBED BURNS



(Chris Snyder)

Mahaska County.

Dressed in yellow, flame resistant *Nomex* clothing, Chris Snyder, (torch & flapper) and Rod Van Donselaar (backpack spray pump) begin a roadside prairie burn. As more roadsides are planted to native grasses, fire becomes a more important method of brush control.

- Fire is underused as a weapon in the war on brush control.
- Only 30 of Iowa's 99 counties burn roadside ditches seasonally.
- Of these, more than half restrict their burns to prairie remnants and reconstructions.
- A few counties concentrate their burns on snow trap areas.
- Only a handful of counties specifically use fire to help control woody brush.
- Increasing numbers of managers are interested in fire as a brush control tool.

### Issues

- Liability
  - Many county engineers refuse to allow roadside burns for fear of collateral damage to adjacent areas:
    - highway bridges
    - adjacent CRP land, woodlands, fields and out buildings.
  - Roadsides are full of combustible material.
    - wooden objects: sign posts, fence posts, guard rails, utility poles.
    - plastic *Hickenbottoms* connected to drain tile.
    - billboards
    - underground gas lines (fire causes risk of explosion)
    - overhead electric lines (smoke causes risk of arcing)
  - Fire in an urban setting is also dangerous because of traffic control: danger to motorists and workers.
- Jurisdictional Issues
  - In some counties, other governmental agencies do most of the burning:
    - county conservation department
    - Iowa DNR
- Farmers, ranchers and other landowners already burn their ditches.
  - Especially in front of their houses to keep things green in spring.
  - Some inadvertently help maintain roadsides by burning areas previously brushed out by county work crews.
  - Education is important. Landowners often burn on days when fire can escape control.
  - Some counties have a permit process
  - Jackson County allows the public to burn roadsides providing they follow established guidelines.
- Fire is typically rated at 50% effective.

- Fires can be very effective if timed correctly. Factors:
  - How hot the fire?
    - In wooded areas, lack of fuel is the number one problem.
    - If light fuels are present, they have to be of sufficient quality. Smooth brome and Reed’s canary grass often do not create hot enough fires to boil the cambium on woody growth.
    - Deep duff that burns around the roots of large trees can sometimes kill them.
  - How often the fire?
    - Burns several years in a row will help suppress brushy vegetation like sumac and dogwood.
    - As more prairie roadsides are reconstructed, prescribed fire will become a more common tool.
  - How big the trees?
    - Fire is more effective on smaller trees.
    - Once trunks are above 2-3 inches in diameter, fire is less effective.
    - The average fire is not hot enough to kill large trees, though they may be stunted.
    - Effectiveness varies by species.
      - Eastern red cedar most easily killed by fire.
      - Softwoods are thought to be more susceptible.
      - Mulberries are almost impossible to kill with fire.
  - How favorable the weather?
    - Prescribed burns are usually conducted in the spring and fall when fuels are dry and humidity is low.
    - If conditions are correct a fire can be very effective.
    - Plowed fields and roadways make good fire breaks.
    - Summary of preferred weather conditions:
      - wind speed 5-15 mph
      - relative humidity 30-60%
      - temperature 45-75 °F
      - cloud cover clear to 70%
      - ceiling 2000 ft or higher
    - A seasonal burn window is often short. For some, this limits fire as a practical tool.
    - Uncooperative weather sometimes eliminates an entire burn season.

**Did You Know?**

Fall burning is underused as a brush control method.

During ideal fall burn weather, woody areas otherwise lacking in fuel may be filled with dried leaves.

**Safety**

- If you burn
  - Plan for the fire in advance by writing a management plan.
  - Stay within the prescription.
  - Use proper equipment
    - Drip torch, backpack pumps, flappers

- Outfit employees with personal protective equipment (PPE).
  - natural fiber clothing (or *Nomex*) that covers the body, arms and legs.
  - natural material hat to cover the hair
  - leather gloves
  - heavy boots.
  - When near burning trees and brush, wear a hard hat and goggles.
- Know procedures to notify emergency personnel.
  - Notify local fire departments in advance.
- Designate a crew boss.
  - Assign each participant a task.
  - Make sure they understand how to perform that task
- Do not dump smoke on a road without considering temporary traffic control.

**Important**

When conducting a prescribed burn, always have an escape route away from flames.

**References**

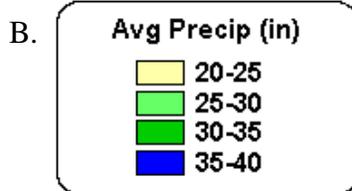
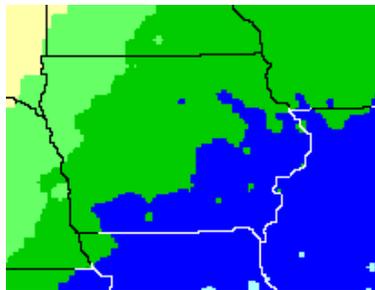
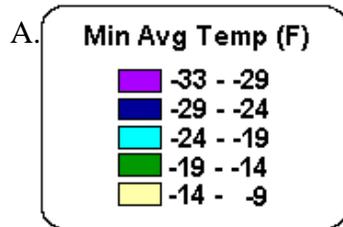
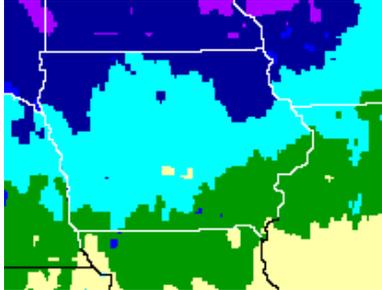
Cluvine S. No date. Planning and Conducting Prescribed Burns in Missouri [Handout]. Jefferson City, MO: Missouri Department of Conservation. Steve Cluvine, Grassland Biologist. Telephone 660 885-6981 extension 241.

**SECTION 6 – PATTERNS OF BRUSH CONTROL IN IOWA**

**6.1 The Setting**

- Iowa’s diversity of vegetation reflects the state’s variability in environmental conditions (MRCC2000) and topography (Prior 1976).

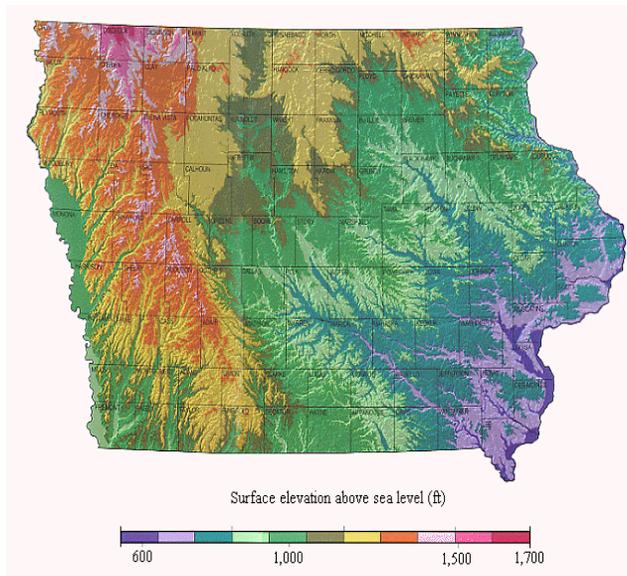
**Climate**



A. Iowa is coldest in the northwest and northeast; warmest in the southeast.

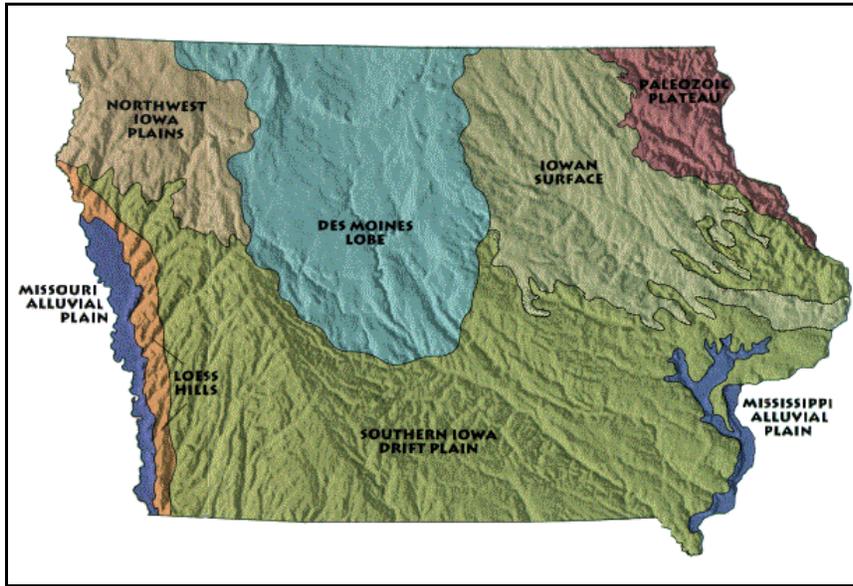
B. Rainfall in Iowa increases northwest to southeast.

**Terrain**



- Shaded relief map showing drainage patterns. Roadside brush problems are greatest in the northeast and southeast.

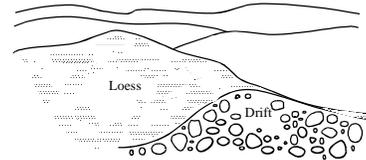
SECTION 6- PATTERNS OF BRUSH CONTROL IN IOWA



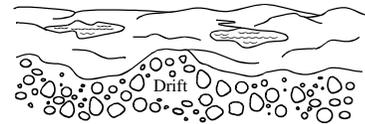
Iowa has 7 Landform Regions:

- Northwest Iowa Plains
- Des Moines Lobe
- Iowan Surface
- Paleozoic Plateau
- Southern Iowa Drift Plain
- Loess Hills
- Missouri & Mississippi Alluvial Plain.

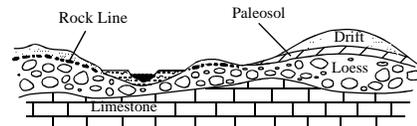
- Northwest Iowa Plains.
  - Loess cap over glacial drift.
  - Farms with windbreaks.
  - Woody plants invading in swales.



- Des Moines Lobe of the Wisconsin Glacier.
  - Thick glacial drift.
  - Meandering rivers.
  - Potholes.
  - True prairie.

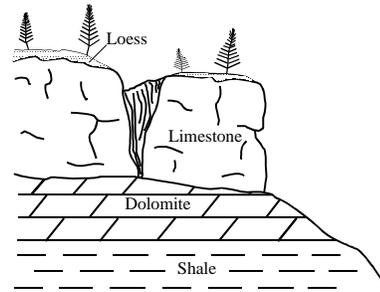


- Iowan Surface.
  - Glacial drift over limestone.
  - Prominent stone line in the soil.
  - More rainfall produces more wooded vegetation.
  - Larger glacial erratics.
  - Pahas: loess ridges over paleosol.

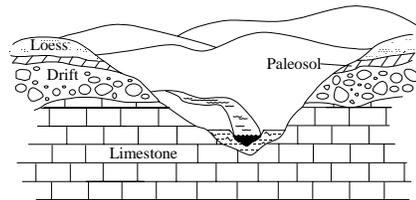


SECTION 6- PATTERNS OF BRUSH CONTROL IN IOWA

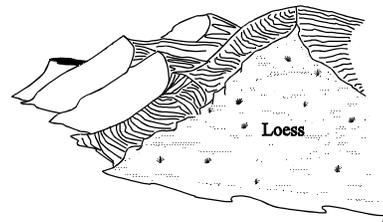
- Paleozoic Plateau.
  - Deep valleys, abundant rock outcrops.
  - Loess cap occurs in some areas.
  - Karst topography common.
  - Limestones, dolomites, and shales interbedded.
  - Heavily forested.



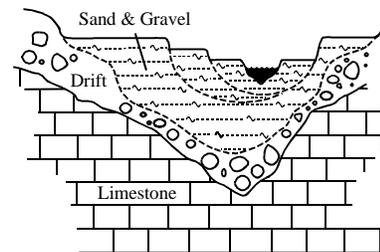
- Southern Iowa Drift Plain.
  - Surface one million years older than northern Iowa.
  - Loess over old drift over interbedded limestone, shale and coal deposits.
  - Sharply dissected
  - Paleosol interfaces with glacial till and loess, seeps occur at boundaries.
  - Scattered tree islands.
  - Many artificial farm ponds.



- Loess Hills.
  - Loess and alluvium cover old drift.
  - Loess in some places 350 ft deep.
  - Prairie with cedar forests in valleys.



- Mississippi & Missouri Alluvial Plains.
  - Most geologically active areas in Iowa.
  - Alluvial sand and gravel cover old drift and limestone.
  - Multiple benches represent different periods of flow.
  - Forests and wet prairies.



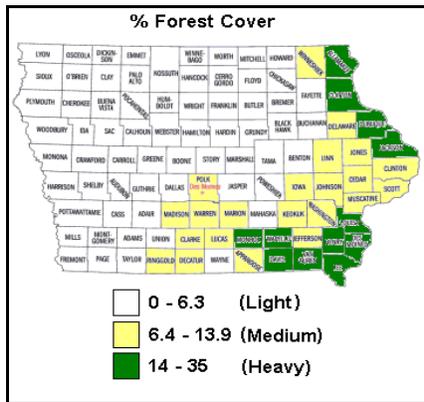
**References**

Gigliano JD. 1999. Shaded relief map of Iowa [Map]. Iowa City, Iowa: Geological Survey Bureau. <<http://www.igsb.uiowa.edu/browse/reliefmp/relief.htm>>. Accessed 2002 Jul 19.

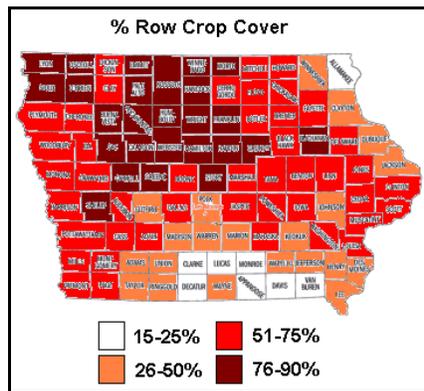
SECTION 6– PATTERNS OF BRUSH CONTROL IN IOWA

- [IDNR] Iowa Department of Natural Resources. 2002. Landform regions of Iowa [Map]. Iowa City, IA: Geological Survey Bureau.  
<<http://www.igsb.uiowa.edu/browse/landform.htm>>. Accessed 2002 Jul 19.
- Norgord D. 2002. Average annual precipitation: conterminous United States: 1961-1990 climate period. Mt. Horeb, WI: Geographic Techniques.  
<<http://personalpages.tds.net/~gordies/USprecMap.htm>>. Accessed 2002 Aug 22.
- [NRCS] National Resource Conservation Service. 2000. Minimum temperature for January: coterminous United States: ascii grid. Fort Worth, TX: National Cartography and Geospatial Center. <[http://www.ftw.nrcs.usda.gov/prism/prismtemp\\_us.html](http://www.ftw.nrcs.usda.gov/prism/prismtemp_us.html)>. Accessed 2002 May 2.
- Prior JC. 1976. A regional guide to Iowa landforms. Iowa geological survey education series 3. Iowa City, IA: the State of Iowa. 72 p.

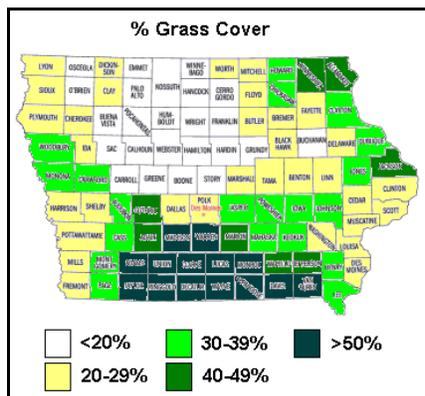
## 6.2 Vegetation and Land Use Patterns



- Percent Forest Cover in Iowa.
  - The heaviest forest growth is in northeast and southeast Iowa.



- Percent Row Crop Cover in Iowa.
  - Predominantly corn and soybean fields.
  - The epicenter for row crop production is in north central Iowa with 3/4ths or more of the land in cultivation.
  - Only the Southern Iowa Drift Plain escapes cultivation due to steep hills.



- Percent Grass Cover in Iowa.
  - Cover includes pastures, set aside land, fallow fields, roadside ditches and prairies.
  - This map is reciprocal with Row Crop Cover.

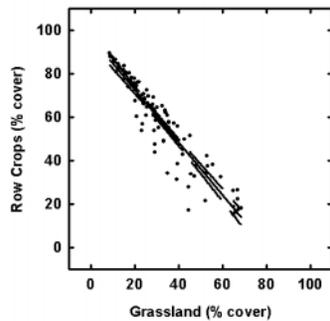
### Resources

IOWA DNR. 2002. Remote sensing data. Unpublished.

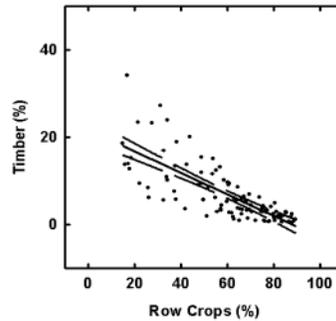
### 6.3 Correlation: How Farming Patterns Tend to Predict Control Methods

#### Data Interpretation

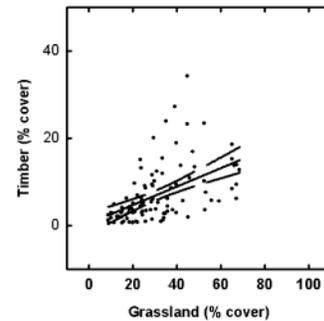
- Relationships in land cover.
  - Estimates of % cover for row crops, grassland, and forests were made with remote sensing data.
  - A Pearson Product Moment Correlation test was used to find a correlation between cover types in each of Iowa's 99 counties.
  - Three significant correlations ( $P < 0.5$ ) emerged.



grassland vs. row crops



row crops vs. forest

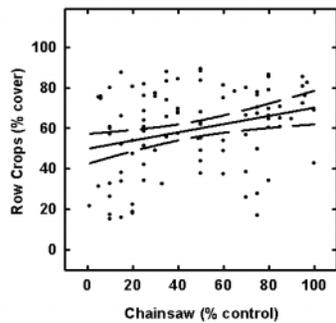


grassland vs. forest

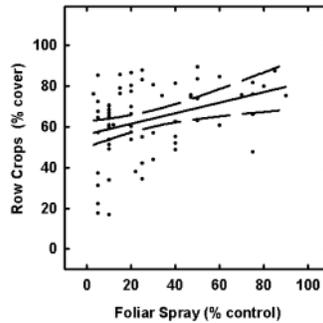
- These relationships are expected.
  - As row crop acres increase, both grassland and forested areas decline.
  - As grassland acres increase, forested acres also increase.
    - In Iowa, most pasture land is unsuitable for crop production.
    - This land is either too steep or rocky to farm.
    - There is little to prevent tree and brush growth in these areas.

SECTION 6- PATTERNS OF BRUSH CONTROL IN IOWA

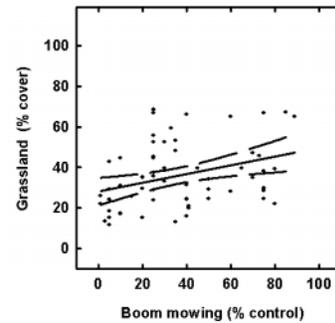
- Relationships between land cover and vegetation control methods.
  - The same Pearson Product Moment Correlation test was also used to find a correlation between cover types and vegetation control methods in each of Iowa's 99 counties
  - Percent control for chain saw, foliar spray, and boom mowing were systematically compared to forest, row crop and grassland percent cover.
  - Six significant relationships ( $P < 0.5$ ) were found between grassland cover and row crop cover vs. chain saws, foliar spraying, and use of boom mowers.
    - The three of greatest interest are displayed.



chain saw vs. row crops



foliar spray vs. row crops



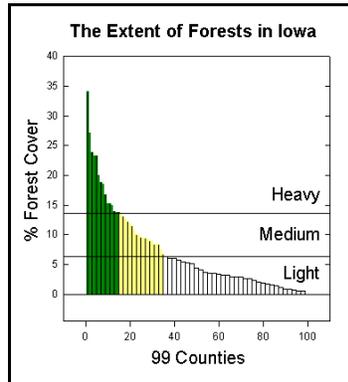
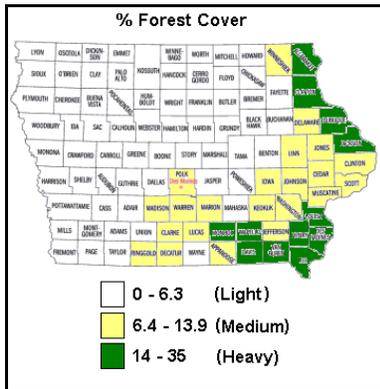
boom mowing vs. grassland

- Summary of relationships
  - In counties that are heavily farmed, chain saw and foliar sprays tend to be more commonly used to control roadside brush and trees.
  - In counties where grassland is common (pastures, prairies, CRP land), boom mowing tends to be more commonly used to control brush and trees.
- Factors that may affect these relationships
  - Economics
    - Better funded counties are able to afford labor intensive chain saw work and relatively expensive foliar chemicals.
    - Less well funded counties default to boom mowing.
  - Politics
    - Foliar spray is accepted in counties where row crops predominate,
    - Foliar spray is rejected by counties with universities, affluent rural urban residents, autumn foliage tourists, and counties with a history of damage claims for lost crops.
  - Topography
    - Chain saws are dangerous to use where slopes are steep.
    - Land not in crop production is either grazed as pasture, fallow for CRP, or forested.
- Surprisingly, there were no correlations between the amount of forest in a county and any control method, including the use of heavy equipment.

**Conclusions**

- The amount of cropland or grassland in a county can be used to predict how that county will control its roadside forest and brush.
- The amount of forest in a county has no predictive value for how that county will control its roadside forest and brush.
- Roadside vegetational control by chain saws and foliar spray tends to increase in counties where row crops predominate, and boom mowing tends to increase in counties where grassland predominates (pastures, prairies, CRP land).

## SECTION 7 – INTEGRATED ROADSIDE VEGETATION MANAGEMENT (IRVM)



(Data courtesy Iowa DNR)

- With so many methods of brush control to choose from, what’s a manager to do?
- Here we offer typical integrated prescriptions for light, medium, and heavy vegetation (arbitrary, divisions based on graph at left).
- These prescriptions are a composite of data from all 99 counties.

- *Appendix C – Extent of Forest Cover in Iowa* details:
  - Acres of forest cover
  - Percent forest cover
  - A ranking of counties from most to least forested.

### Iowa Summary

- On a scale of 1 to 6, with 6 being the highest satisfaction:
  - How satisfied are you with your ability to keep up with roadside tree and brush maintenance?
    - Average = 3.62
  - How satisfied are you with the quality of tree and brush maintenance of each roadside section completed?
    - Average = 4.42
  - How satisfied are you with your county’s overall roadside tree and brush control program?
    - Average = 3.95

*“We’ve attacked brush with a 4-pronged approach [chain saw & stump treat, boom mower, tree shear, foliar spray] and it seems to be working. Not only are we maintaining in all areas, but we seem to be winning in some places.”*

– Rick Dailey  
Roadside Manager  
Page County

## 7.1 Light Vegetation

### Average County

- Land intensely farmed.
- Most rural residents are farmers.
- Residents want roadsides clean from fence line to fence line.
  - They want weeds dead right now.
  - Foliar spray is not only accepted but expected.
- Once county crews clean up a fence line, some landowners begin regular mowing.
- Small brush control budget.
- County is on a rotational maintenance system.
  - Each area is covered by work crews every 0-4 years.
- Few counties have a roadside manager program (RMP).
  - Interest is limited by budgets.
  - Managers who claim RMP's don't work are likely from a county that invested minimally in a past program, then discontinued the program when it didn't produce grand results.

*“This category is probably too broad. I’ve worked in 2 of these ‘light vegetation’ counties. Roadside brush in one was much worse than the other. In fact, they’re not even comparable.”*

– Brian Keierleber  
Engineer  
Buchanan County

### Integrated Control Methods

- Tractor operators mow clear zones with rotary grass mowers.
- Saplings and single trees are felled with light equipment.
  - Lopper.
  - Bow saw.
  - String trimmer with a brush blade attached.
  - Chain saws with 12-15 inch guide bars common.
  - Excavator with a thumb.
    - Worker notches a tree with a chain saw.
    - Excavator operator topples the notched tree with the bucket.
    - Using the thumb and bucket, the excavator operator picks up the cut tree and hauls it to a brush pile.
  - All cut stumps are chemically treated.
  - There is no need to return and foliar spray resprouting shoots since rotational maintenance eventually gets these.
- Pruning overhead branches.
  - Pole saw.
  - An aerial lift bucket is used to position a chain saw operator to prune higher branches.
  - Boom mowers equipped with grass blade cut both light brush and weeds.
  - Cut stumps are chemically treated when they can be reached.
- Killing plants.
  - Basal bark spray rarely used to kill single trees in sensitive areas.
    - Expense of treating single trees prohibits most from using this method.
  - Excavator or road grater used to grub out single trees and plum thickets by the roots.
    - Thumbs on excavators used to pull trees out by the roots.

#### SECTION 7 – IRVM

- Extensive foliar spray program.
- Disposal of plant material.
  - Cut trees are left in the ditch providing that cut brush is not a clear zone hazard.
  - Cut trees are chipped into the ditch.
    - If county owns a chipper, it handles small logs 6-8 inches in diameter.
    - Chipper may be borrowed from adjacent county.
  - Foliar sprayed brush may be left to stand.
  - Cut trees are piled and burned.
- Seasonal burns target roadside prairie remnants.
  - Few counties burn ditches.
  - Most of the burning is done by private landowners who usually burn roadsides adjacent to their homes.
  - Burning higher quality fuel can kill trees with trunks up to several inches in diameter.

## 7.2 Medium Vegetation

### Average County

- Land may be intensely farmed, or fields are interspersed with suburban homes.
- Residents are a combination of farmers, absentee landlords, and affluent suburban residents.
  - Many landowners say brush control is the county's job.
  - Suburban residents are changing the face of county politics.
- Two distinct interest groups.
  - Those who want roadsides clean from fence line to fence line.
  - Those who like trees and brush in the clear zone because it looks "natural."
- A medium to very large budget for tree and brush control.
- Foliar spray use may be questioned by the public.
- County is either on a long rotational maintenance (5-10 years) or playing catch up.
- Roadside Manager Programs are common.

### Integrated Control Methods

- Single trees are felled with a variety of equipment.
  - Chain saws with 16-20 inch guide bars common.
  - Excavator with a thumb and bucket.
    - Worker notches a tree with a chain saw.
    - Excavator operator topples the notched tree with the bucket.
    - Using the thumb and bucket, the excavator operator picks up the cut tree and hauls it to a brush pile.
  - Tree shear.
    - Chain saw crews follow tree shear and cut tall stumps down to 3-4 inches.
  - County may contract with outside services to remove big trees.
  - All cut stumps are chemically treated.
  - There may be a return visit to foliar spray resprouting shoots.
    - Usually within the first two years.
    - Sprouts treated with fosamine ammonium.
- Pruning overhead branches.
  - An aerial lift bucket is used to position a chain saw operator to prune higher branches.
  - Boom mowers equipped with either a grass blade or brush blade.
  - Brush cutters and tree shears operate from either the road or the ditch.
  - Cut stumps are chemically treated when they can be reached.
    - Some would equip their boom mower with a wet blade if it were available (this automatically applies herbicide).
  - Some counties use custom-built equipment.
    - Limb Lopper
    - Remote spray nozzle on boom mower.
- Killing plants.
  - Foliar sprays are integrated with other methods.
    - Most foliar sprays are restricted to 6-8 feet.
      - Fosamine ammonium is used to soak taller trees.

## SECTION 7 – IRVM

- Usually applied to twiggy brush such as willows or cottonwood saplings.
- The county may not have a spray program because of past lawsuits claiming drift damage or health concerns.
- Basal bark spray used to kill single trees in sensitive areas.
- Excavator or road grater may be used to grub trees out by the roots.
  - Thumbs on excavators used to pull trees out by the roots.
- Heavy equipment used to permanently remove snow and ice traps.
  - Cheaper than continually pushing snow.
  - Vegetation removed.
  - Roadside may be recontoured.
- Heavy equipment such as bulldozers and excavators that are used to restore drainage to ditches.
  - Trees are lost as collateral damage.
- Disposal of plant material.
  - Cut trees are left in the ditch providing that cut brush is not a clear zone hazard.
  - Cut trees are chipped into the ditch or hauled away.
    - If county owns a chipper, it handles medium logs 8-12 inches in diameter.
    - Chips are considered a resource and may be offered to landowners.
  - Foliar sprayed brush may be left to stand.
  - Cut trees are piled and either burned or left for wildlife habitat/erosion control.
- Seasonal burns target roadside remnants and prairie reconstructions.
  - 25% of counties burn ditches
  - A few may use burns to target trees and brush.
  - Poorer quality fuel makes it difficult to kill trees.
  - Burns to control tree saplings may become more frequent as acres of roadside prairie in these counties increase.
  - Prescribed spring burns common.
    - Consider fall burning using fresh leaf litter as fuel source.
  - Burns can be dangerous in urban areas along high volume traffic roads.

### 7.3 Heavy Vegetation

#### Average County

- Land use varies with topography.
  - Row crops in flat areas.
  - Pastures, prairie remnants, CRP land on gently sloping ground.
  - Forest on steeply sloping land and river bottoms.
- Residents a combination of farmers, absentee landlords and summer homes.
  - Many landowners say brush control is the county's job.
  - Many like being surrounded by trees and don't want the county cutting them down.
- A medium to large budget for tree and brush control.
- Foliar spray use very unpopular with many.
  - Applicators keep a low profile.
- Crews can barely keep up with advancing vegetation.
  - County has little or no hope of achieving rotational maintenance in many areas.
  - Managers may be considering extraordinary investments in timber felling equipment.
- Roadside Manager Programs are established, but are low paying and turnover is high.
  - Some counties are considering offering higher salaries for more skilled roadside managers.

#### Integrated Control Methods

- Terrain is often limiting.
  - Slopes are a hazard to operators of hand-held equipment.
  - Slopes limit placement of mechanized vehicles.
- Single trees are felled with heavier equipment.
  - Chain saw.
    - 16-20 inch guide bars common.
    - 21-30 inch guide bar "Big Bertha" used for very large trees.
  - Excavator with a thumb.
    - Worker notches a tree with a chain saw.
    - Excavator operator topples the notched tree with the bucket.
    - Using the thumb and bucket, the excavator operator picks up the cut tree and hauls it to a brush pile.
  - Tree shear.
    - Chain saw crews follow tree shear and cut tall stumps down to 3-4 inches.
  - Larger, specialized forestry equipment may be considered.
  - All cut stumps are chemically treated.
  - No return visit to foliar spray resprouting shoots since crews can barely keep up with the growth of trees and brush.
- Pruning overhead branches.
  - An aerial lift bucket is used to position a chain saw operator to prune higher branches.
  - Boom mowers equipped a brush blade.
  - Brush cutters and tree shears operate more easily from the road due to steep terrain.
  - Cut stumps are often left untreated due to terrain.

## SECTION 7 – IRVM

- Most stumps are out of reach.
- Some would equip their boom mower with a wet blade if it were available (this automatically applies herbicide).
- Custom-built equipment would be handy here.
  - Limb Lopper.
  - Remote spray nozzle on boom mower.
- Killing plants dead.
  - Foliar sprays limited.
    - Many trees are out of reach.
    - The county may not have a spray program because of past lawsuits claiming drift damage or health concerns.
    - Fall foliage tourism industry concerned about unsightly standing dead vegetation.
    - Organic farmers concerned about contamination of their crops by herbicides. leached from soil in adjacent uplands.
  - Basal bark spray used to kill single trees in sensitive areas.
  - Excavator or road grater may be used to grub trees out by the roots.
    - Thumbs on excavators used to pull trees out by the roots.
  - Heavy equipment used to permanently remove snow and ice traps.
    - Cheaper than continually pushing snow.
    - Vegetation removed.
    - Roadside may be recontoured.
  - Heavy equipment such as bulldozers and excavators commonly used to reclaim miles of roadsides.
    - Common causal factors.
      - Done when the road surface is upgraded from dirt or gravel to hardtop.
      - Done at the request of farmers who want new fence lines or new field access points.
    - Trees and brush removed.
      - Vegetation disposal may be left to private landowners.
    - Drainage restored.
    - Ditches and banks flattened.
      - Resulting shoulders often mowable.
    - Process destroys prairie remnants.
      - Take care to conserve non-target plant communities.
    - Bare soil reseeded with hydro mulcher.
      - County may be able to offer different seed mixes.
        - Brome/clover mix.
        - Prairie mix.
- Disposal of plant material.
  - Cut trees are left in deep ditches.
  - Cut trees are chipped into the ditch or hauled away.
    - County chipper handles medium logs 12 inches or greater in diameter.
    - Chipper may have a grapple to handle large logs.

SECTION 7 – IRVM

- Chips considered a resource and may be offered to landowners.
- Cut trees are piled and either:
  - Burned.
  - Left for wildlife habitat/erosion control.
  - Used as firewood.
- Timber is sold to lumber interests.
- Forests too shady for burning.

## 7.4 Establishing a Rotational Maintenance Plan



Buchanan County: A recently cleared right-of-way.

(Greg Schmitt)

- About 30 counties have achieved or are nearing a maintenance rotation.
  - 4 have so little brush to control that they only respond to seasonal complaints.
  - 5 cover the county every 1-2 years
  - 10 cover the county every 3-5 years
  - 9 cover the county every 6-10 years
  - 2 cover the county every 20 years
- Rotation usually refers to the methodical application of mowing and foliar treatments.
- In most counties, tree and brush removal are intermittent winter jobs to be done during times when there isn't snow to clear.
- The concept of rotational maintenance is limited to counties with light to medium roadside brush.
  - Managers of counties with heavy roadside brush agree they have little hope of achieving maintenance rotation unless a drastic change occurs in their programs.
    - More money.
    - More manpower.
    - Purchase of big ticket forestry equipment developed to harvest timber in irregular terrain.

*“The county is on a 3-year cycle where we hit any area 2 years in a row, then rest a year. If we have to cut a tree, we’ve failed since it got ahead of us.”*

– Loren Lown, Roadside Manager, Polk County

*“We’re slowly getting into a maintenance mode. We think we will be cutting fewer trees in the next 5 years because we’re simply cutting smaller and smaller trees.”*

– Paul Jacobson, Engineer, Humboldt County

*“We’re expending a reasonable effort, but its not the Herculean effort that needs to be done. We’re not going to be caught up in 10 years.”*

– Michael Olson, Engineer, Jasper County

## 7.5 Documenting Work



The documentation of daily work completed along county roadsides varies widely from county-to-county. If a landowner complains that county work crews have damaged his property, do records exist to show where crews have and have not been?

### Iowa Summary

- Do you document tree and brush removal?
  - Yes 77%
  - No 23%

(Note survey error. There was no distinction made between spray and mechanical cutting control records, so considerable detail was lost. Pesticide laws require that counties keep records of where applications of regulated products occur.)

- If Yes, how?
  - 41% Map (usually makes notes on a map & highlights work areas)
  - 30% Paper files, forms, journal, workbook
  - 13% Photography
    - Mostly before and after documentation in case of controversy.
    - Also has value for interpretive purposes.
  - 11% Employee time sheets or time cards.
  - 2% Keeps records on a computer
  - 2% Tracks data with satellite technology.
  - 1% Work order system

- *Appendix D – Record Keeping: 2. Documenting Integrated Vegetation Management* offers a sample form used by Bremer County.
  - Employee time sheets have a county map printed on the back (11 x 17 in).
  - Employees can make notes and highlight with colored markers (different colors for different days) where they've worked on any given day.

*“These paper files [documenting work] are not anything we keep on hand over long periods of time. They end up going to the wastepaper basket after a few years.”*

– Stephen Reitz  
Engineer  
Wright County

## 7.6 Getting the Public Involved



- When do you notify landowners if working near their home?
- Is it helpful to have land owners do their own roadside brush control?
- Should landowners be encouraged to do even more roadside brush control?

### Iowa Summary

#### 1. Do you notify landowners before cutting or spraying near their home?

- 44% Yes
  - 8% Sometimes
  - 47% No
- Notify if:
    - Working close to a home.
    - Working on the backslope.
    - Know that the landowner will be concerned or unhappy.
    - Special plants involved.
      - Landscape plants.
      - Windbreaks.
      - Shade tree next to a livestock area.
    - Have to clear cut a lot of brush.
    - If we plan to return to chemically treat resprouting after we cut.
    - If there is a written agreement allowing entry onto private lands.
  - Don't notify if:
    - Working in rural areas well away from a home.
    - Working in the ditch bottom or foreslope.
    - Know that its okay with the landowner.
    - Doing minor trim work.
  - Notification methods.
    - Post intent to cut or spray notices in the newspaper and just work.
    - Knock on the doors of landowners if working near their homes.
      - It can be hard to find someone at home.
      - What if you are not speaking to the actual property owner?
    - If all else fails, send a letter.
      - Absentee landowners can be difficult to contact, even by mail.

*“We pretty much know our neighbors and will notify a few landowners when cutting if we think they don't like it.”*

– Bryce Schaben  
Roadside Manager  
Shelby County

SECTION 7 – IRVM

- What to tell the landowner?
    - What is being done.
    - Where the work is being done.
    - When the work being done.
    - Why the work is necessary.
    - How the work is being done.
  - Dealing with landscape plants in or near the clear zone: one solution.
    - If there are landscape plantings too close to the road, a letter is sent to the landowner giving them 30 days to move the planting.
    - After 30 days, a second letter is sent notifying them that they have failed to move their plantings, and that the trees will be removed by the crews.
    - Landowner may be charged for removal.
  - *Appendix E – Roadside Work Public Relations Form* offers a sample form used by Cerro Gordo County.
    - Residents can fill out contact information and note concerns.
    - Managers can respond directly to these concerns or complaints.
    - Managers then have a way to notify a landowner when a project is complete and describe what has been done.
2. It is estimated that about 15% of landowners in each county do some voluntary roadside tree and brush maintenance.

*“You can’t believe what people will call us and ask us to do that people should do for themselves. The mentality has changed over the years. Especially for people who have moved from town into the country. At one time landowners took good care of their roadside ditches, but no longer.”*

- An overwhelming majority of managers thought this helped the county’s ability to control roadside trees and brush.
  - 78% of managers thought it helped.
  - 17% of managers thought it caused problems.
  - 4% of managers thought it had no effect at all.
- Landowners who mowed their ditches were said to be the greatest help.
- Of those who thought landowners working in roadsides caused problems:
  - 38% Brush left behind in the ditch was a problem.
    - Creates a clear zone hazard
      - Brush blocks visual distance.
      - Tall stumps are still a hazard.
    - Mowing trimmings block proper water drainage.
  - 21% No cut stump treatments produces sucker sprouting.
    - Either way the brush still has to be recut and stump treated.
  - 12% Landscaping in the clear zone through selective cutting.
    - Taking one species but leaving another.
    - Causes sight distance problems at intersections which the landowners then

SECTION 7 – IRVM

expect crews to fix.

- 12% Foliar spray problems
  - Nonspecific herbicides kill desirable vegetation, especially relict prairie plants.
  - Over spray can damage adjacent sensitive areas.
- 6% Other actions harm relict prairie plants.
  - Mowing.
  - Soil disturbance.

3. 78% of managers also would like to see landowners assume more responsibility for managing roadside trees and brush adjacent to their property.

- When these managers were asked: What needs to be done in order to get the landowners more involved?
  - 16% Said that land owners should be offered a tax incentive to do more tree and brush control.
    - Especially around driveways where visibility is a problem.
  - 16% Said that better communication and public education was needed with our office.
    - This outreach should be in the form of television, radio and newspaper advertisements, and mailings to help educate landowners about brush control issues.
      - Proper brush control methods.
      - Chemical safety.
      - Plant identification with an emphasis on desirables vs. weeds.
      - How to avoid soil disturbance.
      - What is the fate of their tax dollars.
    - This would help avoid unwanted intrusion by our crews.
    - Land owners should be allowed to have a say in what goes on next to their property.
    - People need to learn the benefits of not having trees and brush in the roadsides.
  - 14% Were in favor of legislation to require landowners to control their own roadside brush.
    - 3% were opposed to this idea.
  - 5% Were concerned about liability factors.

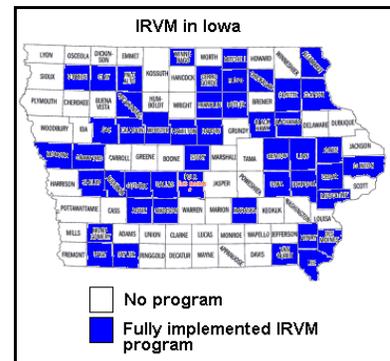
*“As an incentive to landowners, I’ve thought about implementing a program where landowners in the county nominate large farms & small acreages for ‘best kept’ homesteads. Create two categories: large farm/small acreage. Offer a \$100 award for each category annually.”*

– Kris Katzmann  
Engineer  
Taylor County

## SECTION 7 – IRVM

### 7.7 Establishing an Integrated Roadside Vegetation Management (IRVM) Program

- IRVM Provides a comprehensive approach to tree and brush control.
- IRVM is a coordinated decision-making and action process that uses the most appropriate pest control methods and strategies in an environmentally and economically sound manner to meet pest management objectives.
- The elements of IRVM include:
  - prevention
  - monitoring
  - establishing density and action thresholds
  - treating pest problems
  - evaluation
- This concept for Iowa began in 1985 with Black Hawk County.
  - Today 47 of Iowa's 99 counties have fully implemented IRVM plans.
  - IRVM is incorporated into the Iowa Code as §314.22.



#### IRVM Program Objectives (§314.22)

- Maintain a safe travel environment.
- Serve a variety of public purposes including erosion control, wildlife habitat, climate control, scenic qualities, weed control, utility easements, recreation uses, and sustenance of water quality.
- Be based on a systematic assessment of conditions existing in roadsides, preservation of valuable vegetation and habitats in the area, and the adoption of a comprehensive plan and strategies for cost-effective maintenance and vegetation planting.
- Emphasize the establishment of adaptable and long-lived vegetation, often native species, matched to the unique environment found in and adjacent to the roadside.
- Incorporate integrated management practices for the long-term control of damaging insect populations, weeds, and invader plant species.
- Build upon a public education program allowing input from adjacent landowners and the general public.
- Accelerate efforts toward increasing and expanding the effectiveness of plantings to reduce wind-induced and water-induced soil erosion and to increase deposition of snow in desired locations.
- Incorporate integrated roadside vegetation management with other state agency planning and program activities including the recreation trails program, scenic highways, open space, and tourism development efforts. Agencies should annually report their progress in this area to the general assembly.

## SECTION 7 – IRVM

### Application

- An IRVM program is usually directed by a *Roadside Manager* or *Roadside Biologist*.
- This is a full-time position.
  - Title and duties are flexible and tailored to a county's needs.
  - The position title of Roadside Biologist denotes a bachelor's degree in an area of natural resource management or biology.
- It is administratively constructed in one of three ways.
  - Position in secondary roads, supervised by the county engineer.
  - Position in conservation, supervised by the county conservation board director.
  - Position independent, supervised by the county board of supervisors.
- Primary Duties.
  - Brush control.
  - Weed control.
  - Works with landowners to prevent erosion and encroachment.
  - Seeding.
  - Prescribed burning.
  - Identify and manage prairie remnants.
- The position may share duties from another.
  - Park ranger.
  - Naturalist.
  - Assistant engineer.
  - Maintenance superintendent.
  - Maintenance laborer.
  - Weed Commissioner.
- Most of the time, it works best to have one person coordinating IRVM activities.
  - A few counties have a good IRVM effort going without a designated roadside manager.
    - In these cases, work is carried out more or less by committee.

### Did You Know?

The most successful IRVM programs establish good communication between the county engineer and the county

### Iowa Summary

- Where are today's Roadside Managers administratively located?
  - 50% In the secondary road department
  - 36% Under the county conservation board
  - 14% Independent
- Reported Position Descriptions:
  - 29 Roadside Manager or Biologist
    - 2 have the title *Roadside Biologist*
  - 4 Roadside Manager/Biologist AND Weed Commissioner
    - 1 has the title *Roadside Biologist*
  - 1 Roadside Manager AND County Engineer
  - 1 Roadside Manager AND Superintendent of County Roads
- The average roadside manager/biologist has held their job for about 6 years.
- Only 22% of Iowa counties have a written tree and brush removal policy.
  - *Appendix F – Brush Control Policy* offers a sample written policy used by Johnson County.

SECTION 7 – IRVM

**How to create an IRVM program in your county.**

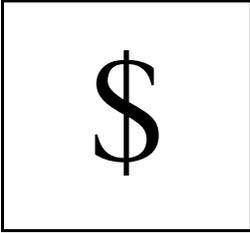
- Legislation.
  - IRVM programs are usually initiated by the county engineer or by the conservation board with help from the county engineer.
  - Occasionally IRVM is brought in by different routes.
    - One or more of the county supervisors provides momentum.
    - Local citizens lobby to gain support of policy makers.
- Planning
  - IRVM programs must be carefully defined before funding is allocated.
  - Choose measurable goals and objectives.
  - Simplified example:
    - What work is to be done?
      - All county gravel roads will be mowed twice each year.
      - All paved roads will be mowed three times each year.
      - 50 miles of brush will be cut along roads x, y & z each year.
    - Who is accountable for progress?
      - Roadside manager is supervised by . . . ?
    - How is this work to be documented?
      - Reports must be presented to the county board of supervisors on a reasonable timetable.
- Final program approval and hiring authority for a roadside manager requires approval from the county board of supervisors.
- Funding:
  - Monies often already exist within the Rural Services Basic Fund portion of county budgets for road clearing.
  - A more detailed discussion of funding an IRVM program is contained in Section 8.2 – *Funding an IRVM Program.*
- The Roadside Program at the University of Northern Iowa was established to assist counties setting up IRVM programs.
  - Contact: Kirk Henderson, Manager  
Native Roadside Vegetation Center  
University of Northern Iowa  
Cedar Falls, Iowa 50164  
Telephone 319 273-2813  
E-mail kirk.henderson@uni.edu

**Important**

A consensus must be reached by county administrators before an IRVM position can be established.

Programs lacking real support have little chance of

## SECTION 8 – BUDGET



- In general, expenditures for tree and brush control in heavily wooded counties are ten times those of heavily farmed counties.
- But if you could compare apples to apples, what is the actual cost?
- That is very difficult to estimate, since every county in Iowa has a different method of accounting for tree and brush control costs.
- Many of these costs are hidden or shared by other budgets.

### Overall Engineer Satisfaction:

- If a county has invested heavily in a roadside manager program, they are very satisfied with brush control.
- If a county has invested minimally in a roadside manager program, they are unsatisfied with brush control.

### 8.1 The High Cost of Roadside Tree and Brush Control

#### Iowa Summary

- County tree and brush control funding trends\*:

	Last 5 Years	Next 5 Years
• Increased	60%	32%
• Decreased	0%	16%
• Stayed the Same	40%	52%

\*March 2002

- The average annual county budget for roadside tree and brush control is about \$75,800.
  - The minimum budget was estimated at \$6,000 for a rural county.
  - The maximum budget was estimated at \$750,000 for an urban county.
- Is your current budget for tree and brush management sufficient to maintain roadsides to your level of satisfaction?
  - 56% Yes
  - 44% No
  - For those who said no, they thought their county an increase in budget that averaged \$82,000 – a little more than twice the average county brush control budget!

#### Program Cost

- Funding for roadside tree and brush control programs comes from a portion of the county's budget called *Rural Services Basic*.
- Since this funding is limited, most brush control projects that are not completely funded directly.
- Instead, it is easier to share costs with other programs.
  - Shared costs occur when brush control resources are idle can be used elsewhere.
  - Shared costs also occur when resources idle in other areas can be used for brush control.

- Costs commonly shared or covered by other funding sources include salary, fuel, buildings, equipment, and administrative expenses.
- Four examples of shared costs:
  1. Office space and utilities.
    - An independent IRVM operation, supervised by the county supervisors, is housed in a spare room at the county garage.
    - Utilities are paid for by the secondary road department and do not show up in the IRVM budget.
    - *Advantage:* The engineer can readily consult with the roadside manager.

<p><b>FYI</b></p> <p>When a county reports its budget for brush control, there are often items missing from that dollar amount – most commonly salary, fuel, and building utilities.</p>
--

2. Equipment and fuel.
  - A roadside manager purchases a new tractor and rotary grass mower.
  - The tractor comes with a loader seldom used by the roadside manager.
  - The county engineer provides all the fuel to operate the tractor.
  - *Advantage:* When not in use by IRVM, the loader can be used by secondary road crews.

3. Equipment and attachments.
  - A county engineer outfits an excavator with a thumb.
  - The excavator is used to build culverts in the summer.
  - The same excavator is borrowed by the roadside manager to topple and stack trees from the clear zone in the winter.
  - The following year, the roadside manager buys a new tree shear that can be attached to the excavator for more winter work.
  - *Advantage:* 1) The IRVM budget can't afford an expensive excavator, but it can afford a relatively cheap tree shear.  
2) The engineer has less use for the excavator in the winter. Its value is increased, and the cost to operate/hour is decreased (finite cost spread over more time).

4. Seasonal work crew with too much down time.
  - Winter snowplow crews may be assigned to cut and remove roadside trees and brush during snowless winter periods.
  - *Advantage:* A productive crew is a happy crew

## Hidden Costs

Note that shared costs are not readily known nor available to many managers, since they are hidden, dispersed throughout the larger budget.

- A partial list of roadside tree and brush control costs might include:
  - salaries
    - permanent
    - seasonal
    - contractors
  - outfitting workers
    - initial costs
    - uniform replacement costs
  - fuel: gas & oil
  - vehicle maintenance
  - equipment purchase
    - small vs. very large
  - equipment maintenance
    - from chain sharpening to fixing broken boom mowers
    - in-house vs. outside garage repairs
  - chemicals
    - other spray costs
  - other mowing costs
  - insurance paid
    - policy premiums
    - workers compensation due to accidents
  - liability paid
    - damage claims for drift
    - damage claims against mechanical cutting
    - liability due to not cutting
    - fire damage
  - extra labor to clean up the work of private landowners
  - heavy equipment costs
  - reseeding costs
    - cost of standard mix vs. special seed mix

*“I think we need to use common sense. We should learn what is effective and use that. We should also consider proven innovative ideas that will save us money.”*

– David Anthony  
Engineer  
Boone County

## 8.2 Funding a Roadside Management Program

- The most comprehensive approach to tree and brush control is to establish an Roadside Management program.
  - To initiate an Roadside Management program, see Section 7.7 – *Establishing an Integrated Roadside Vegetation Management (IRVM) Program*.
- But what does such a program cost?
- Where could a county without a Roadside Management program find the money?

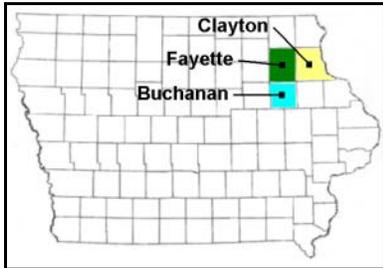
### 2 Options

- Construct a Roadside Management program from scratch.
  - 2 new employees, new chain saws and other mechanical and chemical control
  - Estimated price: \$100,000-\$150,000
    - \$38,000 average salary & benefits/person = \$76,000
    - \$500-1000 chain saws
    - \$10,000 spraying
    - \$15,000-30,000 each for mowers.
- Construct a Roadside Management program as much as possible by transferring existing personnel, duties and equipment from other areas of a department.
  - This avoids high start-up costs since everything already exists.
  - Exact savings depends on how much can be scrounged from other areas.
  - The newly created department is only responsible for maintenance and replacement costs of equipment.
    - The same costs are spread out over a longer period.
  - In addition, big ticket items are shared with other departments.
    - This allows for other areas of the budget to cost share, reducing overhead.
    - Big ticket conservation equipment (i.e. native grass drill, hydroseeder, straw mulch blower, etc.) can sometimes be funded by grants from such programs as the Living Roadway Trust Fund (LRTF).
  - Example: Clayton County (as described by Jerry Weber, county engineer)
    - *“When we created the IRVM program in Clayton County, the roadside manager got [transferred from the secondary road department] a couple of pickups, a truck or two, all the tractors, all the chain saws, etc.”*
    - *“This equipment went from the responsibility of my mechanics to the responsibility of the roadside management mechanics.”*
    - *“When that stuff wears out, he has to replace it out of his budget so every year Louie buys a couple of new chain saws.”*
      - *“The advantage is that he gets to decide where they go.”*
    - By making the new department responsible only for replacement costs, the program becomes more affordable.
- Bottom line: A reasonable investment must be made in any new Roadside Management program.

*“Don’t expect miracles if you are not going to [adequately] fund a new program.”*

–Jerry Weber  
Engineer  
Clayton County

### 8.3 Comparing Budgets: 3 Case Studies



Roadside managers from three counties (Clayton, Fayette, Buchanan) generously provided budget information from Fiscal Year 2002 (July 1, 2001-June 30, 2002).

- Program structure.
  - Buchanan County
    - Roadside Manager is an independent position.
    - Supervised by the County Board of Supervisors.
  - Clayton County
    - Roadside Manager is in the Secondary Road Department.
    - Supervised by the County Engineer.
  - Fayette County
    - Roadside Manager is in the Conservation Department.
    - Supervised by the County Conservation Board Director.
- Program funding is identical, but start-up monies come from different sources.
  - Start up funding:
    - Buchanan Co.: A transfer of equipment from secondary roads.
    - Clayton Co.: A transfer of equipment from secondary roads.
    - Fayette Co.: The Iowa DOT's Living Roadway Trust Fund (LRTF) paid for big ticket items.
  - Annual operating funds: Rural Services Basic.
- All 3 counties prepare their annual budget in much the same way:
  - The roadside manager meets with his supervisor.
  - Together they present the budget to the Board of Supervisors.
  - The Board decides what portions of the budget to fund.
- Budgets are displayed in Table 7 (FY 2002).
  - Asterisks (\*\*\*) show expenses covered by a different funding source.

## SECTION 8 – BUDGET

**Table 7. Itemized Roadside Management Budgets for 3 Iowa counties.**

<b>CODE</b>	<b>ITEM</b>	<b>Buchanan</b>	<b>Clayton</b>	<b>Fayette</b>
<b>EMPLOYEES</b>				
	Salary	26,311	***	60,500
	Part-time	18,590	***	15,000
	FICA	3,435	***	5,700
	IPERS	2,582	***	4,300
	Insurance	5,802	***	10,500
	Workmen's Comp. Insurance	0	***	1,950
	Life Insurance	***	***	165
<b>TRAINING &amp; UNIFORM</b>				
2610	Books, Periodicals	0	0	
4220	Schools/Certifications/Meeting Fees	360	252	250
	Uniform Allowance	***	***	700
<b>LIABILITY</b>				
	Tort & Liability Insurance			230
	Legal Services	***	***	600
<b>SUPPLIES</b>				
2190	Chemicals - Brush	8,000	***	5,000
2190	Chemicals - Weed	2,500	11,874	NA
2030	Seed & Fertilizer	7,000	986	NA
2140	Traffic & Sign Materials	0	0	
2150	Wood & Lumber Products	0	0	
2320	Custodial Supplies	from 2nd roads	329	
2930	Safety/Protective Supplies	see #2410	513	500
<b>OFFICE &amp; COMMUNICATIONS</b>				
2600	Office Supplies	500	0	from CCB
4000	Publishing Notices	see #2600	0	from CCB
4140	Telephone	1,380	0	from CCB
4410	Building Repairs	from 2nd roads	6	125
4460	Radio Repairs	from 2nd roads	0	
<b>UTILITIES</b>				
	Gas (heat)	***	***	500
	Electricity (light)	***	***	375
<b>EQUIPMENT &amp; TOOLS</b>				
2410	Machinery & Equip/Parts	3,500	2,106	750
2900	Minor Equip. And Tools	1,000	4,799	1,300
6310	New Equipment	see #2410	26,256	8,000

## SECTION 8 – BUDGET

**Table 7. (Continued)**

<b>CODE</b>	<b>ITEM</b>	<b>Buchanan</b>	<b>Clayton</b>	<b>Fayette</b>
<b>VEHICLES</b>				
	Fuel	***	***	6,500
2510	Lubricants	see #2410	491	132
2530	Tire & Tubes	see #2410	1,556	***
2540	Vehicle Parts	see #2410	13,376	***
4951	Licenses & Permits	see #2410	90	***
	Mileage and Subsistence	100	76	350
	Insurance (Vehicles)	600	***	1,400
<b>VEHICLE/EQUIPMENT REPAIRS</b>				
4430	Equipment Repairs (out sourced only)	see #2410	7,513	6,000
4810	Wd Comm Reimb to Sec Rd Dept	***	2,362	***
<b>TOTAL</b>		\$81,660	\$72,586	\$131,327

*“I can’t dedicate the time and manpower I need to keep up with the fast growing brush in this county. On top of that, they’re cutting budgets, and the first thing to go are the cosmetic things like brush control. Never mind that it’s a safety issue.”*

– J. Thomas Stoner  
Engineer  
Harrison County

*“First our brush control budget increased, then it decreased. We did an all-out assault to get on top of things but after that, it became routine maintenance.”*

– Joe Kooiker  
Roadside Biologist  
Story County

## SECTION 9 – ROADSIDE BRUSH AND THE IOWA CODE



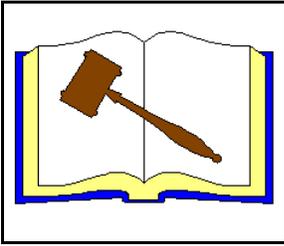
(Iowa Tourism Office)

*“We need to change the laws to give more clarity to who owns what and where the responsibility lies. If people like trees in the ditch, are they responsible for the consequences? If they don’t want trees in the ditch, are we responsible for removing them? Brush and trees don’t help the road at all.”*

– Eldon Rike, Engineer, Adams County

### 9.1. Iowa Summary

- County engineers and roadside managers are split in their opinions over the Iowa Code.
- When asked the question: Do you feel the Iowa Code is helping or hindering the process of trying to maintain roadside trees and brush? We received the following response:
  - 26% Helping
    - The code gives the county all the authority it needs.
  - 27% Hindering
    - The code is too vague and needs to better spell out county manager and landowner rights and responsibilities;
  - 47% No Opinion
    - Not informed enough about the code to comment.
- It is the opinion of the authors that on the subject of roadside brush control, the Iowa Code is vague.
- Historically there have been several attempts to reform the Iowa Code on the matter of brush control but all efforts have failed.
- A discussion of the politics behind the process is beyond the scope of this project, as is reform of the code itself.
- To help managers and engineers better understand application of Iowa Code to brush control, a review of relevant code sections and other notes follow.



*“The law is terribly vague on brush control. As things stand now, counties only have two angles: either brush has to be in harms way for drainage problems, or it has to be causing a safety hazard. Either way, you have to make a great case before you can take action.”*

– Michael Olson, Engineer, Jasper County

## 9.2. Sections of the Iowa Code that Apply to Brush Control

### I. Review of Iowa Code.

- Responsibility of Land Owner to Remove Vegetation
  - 317.10 Noxious weeds on private property adjacent to highway ROW. Other weeds on land adjacent to highway ROW which render the adjoining highway unsafe for public travel.
  - 331.384(1)(b) County: Diseased trees and dead wood off ROW
  - 364.12(3)(b) City: Diseased trees and dead wood off ROW
- Responsibility of County to Remove Vegetation
  - 331.384(1)(b) in accordance with §317.11 Noxious weeds on highway ROW
  - 317.6 Noxious weeds on adjacent property where owner fails to control.
  - 331.384(1)(b) County: Diseased trees and dead wood on ROW
  - 364.12(2)(c) City: Diseased trees and dead wood on ROW
  - 314.7 Removal of material obstructions on the highway: applies to trees.
  - 331.362(7) In accordance with §319.
  - 319.1 A general obligation to remove obstructions. Remainder of chapter does not apply to vegetation.
  - 331.384(1)(a) County may abate nuisance whether public or private in any reasonable manner.
  - 331.384(1)(f) County may require cutting and destruction of weeds or "other growth" which constitutes a health, safety, or fire hazard. This authority is general and is applicable to both highway ROW and to land adjacent to the road.
  - 331.362(2) Road maintenance is responsibility of County Engineer in accordance with §306, 309, 310 and 314; see §309.21.
  - 314.22(1)(a) Roadside vegetation may be managed to maintain a safe travel environment.
  - 317.26 DNR Director in cooperation with Secretary of Ag and CCB's or Boards of Supervisors may develop alternative practices to remediate noxious weeds and "other vegetation" within highway ROW.

SECTION 9 – ROADSIDE BRUSH AND THE IOWA CODE

- Defining Vegetation Terms
  - 317.10 County: "Other weeds" includes all weeds other than noxious weeds.
  - 317.26 County: "Noxious weeds and other vegetation"
  - 364.12(2)(g) City: includes noxious weeds and all other vegetation.
  - 314.22 County: IRVM "Roadside vegetation" includes all weeds and all other vegetation including noxious weeds.
  - 331.384(1)(f) County Home Rule: "Weeds and other growth" includes all weeds noxious and otherwise and other vegetation.
  
- Owner Prevented From Landscaping ROW
  - 319.13(4) Owner not allowed to place obstructions in a highway ROW.  
Does this include landscape trees and shrubs?
  
- Right of County to Drainage in Highway ROW
  - 468.138 County may remove any obstruction within the ROW that interferes with water flow in ditches, drains and laterals. Includes trees, hedges, or shrubbery and the roots thereof.
  - 468.139 Right to acquire and destroy items in §468.138.
  - 468.347 County may remove trees, hedges, or shrubbery from private land if the roots growing into the ROW are blocking drainage.
  
- Owners Given Some Protection from Roadside ROW Maintenance
  - 468.346 Exempt from ROW removal: shade or ornamental trees adjacent to a home, farm building, or feedlot; any tree in a windbreak if used to protect cultivated lands but only if soil is light or sandy.
  - 468.347 Exempt from removal on private land adjacent to ROW: Ornamental trees adjacent to any dwelling; orchard trees and windbreak trees protecting a dwelling, farm building, or feedlot.
  - 658.4 Treble damages to owner for willful injury to trees and shrubs along land held by the state for any purpose.

II. Highway design and roadside maintenance safety standards and research available to assist in defining a material obstruction.

- AASHTO Policy on Geometric Design of Highways and Streets 1990 - Discusses the need for horizontal clearance to obstructions and recommends using the AASHTO Roadside Design Guide to define roadside clear zone widths and embankment slope, p.343.
  
- AASHTO Roadside Design Guide, January 1996 - Recommends 9 meter clear zone without trees being established as a stand for more heavily traveled roads and suggests how to determine lower standards for low volume, low speed roads.

SECTION 9 – ROADSIDE BRUSH AND THE IOWA CODE

- AASHTO Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT $\leq$ 400), 2001 - Allows for up to a 2 meter clear zone with the provision that where not practical, none is required, p.48-9.
- US DOT Roadside Improvements for Local Roads and Streets, October 1986 - Discusses fixed objects determined to be safety hazards, p.13. A single tree will abruptly stop a vehicle where it has a diameter greater than 4 inches, p.16, and provides guidance to determine a realistic clear zone, p.29.
  - Cottonwood, willows, soft maples, mulberries, box elders, Siberian elms and other fast growing trees - may require removal when they are 4 inches or more in diameter as potentially deadly fixed obstacles threatening the safety of the traveling public, p.16.
- US DOT Guide to Management of Roadside Trees - FHWA Report IP-86-17, December 1986. Information of special significance in this guide include:
  - The Road Environment Statistics on accidents involving trees on rural roads notes that accidents involving trees is mainly a rural phenomena. Of the total accidents 81.6% occurred on rural roads. 70.8% of the injury producing and 65.8% of the property damage only, vehicle/tree accidents occurred in unincorporated areas, p.3-4.
  - Most accidents involving trees occur within 30 feet of road edge, p.5.
  - Smaller trees of 6 inches in diameter have caused fatal crashes, p.5.
  - Accident profiles indicate more vehicle tree accidents occur on straight roads, p.7.
  - Curved rural local road sections have also been areas of high risk of fatal accidents with trees, p.9.
  - A method to evaluate higher risk roadside tree environments is offered, p.15.
  - Recommends a procedure to select a treatment for tree removal involving contract with property owners, p.312.
  - Advice is provided on how to prepare for litigating removal of trees, p.52.

*“People don’t understand what’s in the code and think we can cut brush for any reason. The way I interpret it, if it’s not a hazard or a drainage problem, we can’t cut. We’ve had all kinds of requests to cut from the public. We’ve even had requests to cut to improve satellite reception for a dish antenna. In general, we need to educate the public about what’s in the Iowa code and what it allows us to do.”*

– Clark Schloz, Engineer, Jackson County

III. Defining a material obstruction under the Carstensen Rule §314.7.

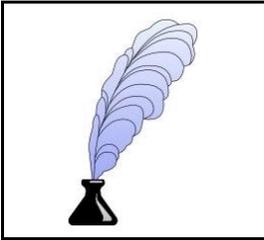
- *Appendix G – Legal Opinions* offers supporting court case details.
- Material obstructions as defined by the Iowa Supreme Court include:
  - The road includes shoulders, fore slopes, ditch bottom and back slopes are part of the road. Carstensen v. Clinton County, 94 NW2d.734 (Iowa 1959), p.735.

## SECTION 9 – ROADSIDE BRUSH AND THE IOWA CODE

- Brush and trees in ditches and on the back slopes of the north and west side of roadway which increase snow drifting - Carstensen, p.735.
- Fore slopes and ditch bottom shading on the south and east side of roadway which slow thaw of ice - Carstensen, p.735.
- Weeds or woody materials in right-of-way obstructing view within a reasonable distance in advance of intersecting roads - Carstensen, p.736.
- Trees and obstacles within a 6 inch wide bottom of a ditch or which interferes with the future maintenance of the ditch - Carstensen, p.736 and Harrison v. Hamilton County 284 W456, 457 (Iowa 1939) where trees are located in a standard cut and fill section; See also Rabiner v. Humboldt County 289 MW 712 (Iowa 1938) where removal required to build a standard road or to widen a roadway to a standard road width.
- Overhanging tree branches or other vegetation which prevent persons entering the highway from observing oncoming traffic - Carstensen, p.736.
- Trees in the center of the roadway ditch - Harrison v. Hamilton County 284 NW 456 (Iowa 1939).
- Changing Concepts for Defining a Material obstruction
  - Prior to the development of uniform design standards for secondary roads general deference was given to the landowners ownership of trees located in easement right of way so that the need for removal of trees was generally reviewable through the court system. This is no longer the case as the Carstensen case specifically rejected the case law that supported it. See Carstensen, p.737.
  - The Carstensen rule recognizes the need to comply with design standards required to construct and maintain a safe highway in accord with prevailing highway safety related design and maintenance standards. Under the Carstensen rule the county has the authority to remove trees and other vegetation which needs to be removed in order to maintain the safety and integrity of the highway in accord with statewide or generally accepted maintenance standards and policies.
  - Uniform roadside vegetation management plan authorized by 425(1)(a) are intended to "maintain" a safe travel environment. It is no longer necessary to allow a circumstance to deteriorate to the point at which the highway is obstructed before the County can act to remove trees, other weeds, or other vegetation if the removal is required to properly maintain the road.

### References

Graham, James E. (Graham Land Acquisition Associates, Suite 2, 1932 S.W. Third, Ankeny, IA 50021). County authority to remove trees and other vegetation from county right of way GLAA PN 1503 [Letter]. Message to: Brian P. Moore (Ringgold County Assistant Engineer, 707 South Henderson, Mount Ayer, IA 50854). 2000 Aug 1. 14 p.



*“I think sometimes the people writing the code get so involved with details that they miss the point [of roadways]: function and safety.”*

– Rich McKnight, Engineer, Clarke County

### **9.3. Recommended changes to the Iowa Code.**

- Clear zone safety should be the main focus of right-of-way tree and brush control.
  - Embrace safety research conclusions.
  - Protect roadway sight restrictions
  - Provide for an obstacle-free clear zone.
- Clarify the rights and responsibilities of property owners & ROW managers.
  - Clarify liability if tree is to be left in the clear zone.
- Impose the fewest changes.
- Codify existing practices.
- Be consistent with existing regulations.
- Protect non-target vegetation from undue harm.
- Preserve drainage.

## SECTION 10 – THE INDIANA BAT

- Iowa DNR 2002 guidelines for protection of the Indiana bat (*Myotis sodalis*), an Iowa endangered species.
- Amendments by the US Fish and Wildlife Service (FWS) and the USDA Natural Resource Conservation Service (NRCS).

### 10.1 The Indiana Bat in Iowa



Indiana bat (Penn GC)

Indiana bat summer range in Iowa.

#### Counties Affected\*

- *Known range:* Appanoose, Cedar, Clarke, Davis, Decatur, Des Moines, Henry, Iowa, Jasper, Jefferson, Johnson, Keokuk, Lee, Louisa, Lucas, Madison, Mahaska, Marion, Monroe, Muscatine, Poweshiek, Ringgold, Union, Van Buren, Wapello, Warren, Washington and Wayne.
- *Potential range:* Adair, Adams, Audubon, Cass, Dallas, Fremont, Guthrie, Harrison, Mills, Montgomery, Page, Polk, Pottawattamie, Scott, Shelby and Taylor.

\*FWS and NRCS concur that the Indiana Bat would be found in areas of suitable habitat in the potential counties if formal census studies were undertaken in those areas. The only reason they are not on the current known distribution list is that no such studies have been done.

#### Period of Effect

- Between April 1 and September 30

#### Status

- The Indiana bat is a federal (50 Code of Federal Regulations, Part 17) and state (Code of Iowa, §481B ) listed endangered species that occurs in parts of southern and southeastern Iowa from May through August.
- Over 85% of the Indiana bat population hibernate in just seven locations in Missouri, Indiana, and Kentucky.

- Protection of hibernation caves and mines has stabilized the eastern population but the western population, which includes Iowa, has continued to decline.

### Identifying Characteristics

*Identification is difficult. The morphology of this species varies considerably across its range.*

- A well developed keel on the calcar, a spur of cartilage leading off the foot and used to support the tail membrane.
- A pink face (due to lack of hair around the nose and mouth).
- Short hairs on the foot which do not extend to the ends of the toes.

#### Did You Know?

Protection of the Indiana bat in Iowa is aimed at avoiding disturbance of nursery colonies.

### Breeding Habits

- Female Indiana bats have their young beneath the loose or peeling bark of trees.
- Most nursery colonies have been found beneath the bark of standing dead trees on the trunk or large branches.
  - Dead trees that retain sheets or plates of bark and which provide space beneath the bark such as red oak, post oak, and cottonwood are potential roost trees.
  - Live trees such as shagbark and shellbark hickory are also used at times for roosting.
- The nursery colonies are located along streams and rivers or in upland forest areas.
  - These areas are also important feeding areas for this species.

### Summer Habitat Requirements

- Within a ½ mile radius of a location:
  - Forest cover of 15% or greater
  - Permanent water
  - One or more of the listed tree species 9 inches dbh or greater
  - At least 1 potential roost tree per 2.5 acres.
  - The potential roost trees ranked as moderate or high for peeling or loose bark
    - Trees either alive or dead
    - Trees with slabs or plates of loose bark
    - Species
      - shagbark hickory
      - shellbark hickory
      - bitternut hickory
      - American elm
      - slippery elm
      - eastern cottonwood
      - silver maple
      - white oak
      - red oak
      - post oak
      - shingle oak

## 10.2 Survey Methods for Indiana Bat Summer Habitat

### Step 1

- Determine if there is 15% or greater forest cover and permanent water in a ½ mile radius of the project site.
  - If not then there is no need to continue survey efforts.
  - Otherwise go to Step 2.

### Step 2

- Conduct a survey of the project area that will be cleared or cut to determine if suitable roost trees are present.
- This will include both upland and flood plain forests.
- Areas that are too large for complete counts may be sampled using techniques such as point-quarter, tenth-hectare quadrats or other acceptable forest sampling techniques.
- Information to collect during sampling:
  - Standing trees 9 inches or greater diameter at breast height (dbh) per acre
  - ( alive or dead ) shagbark and shellbark hickory
  - ( dead ) all other species listed in Section 10.1 that have 10% or greater loose or peeling bark on the trunks and main limbs.
    - The amount of loose or peeling bark is a visual estimation.
- Calculate the number of potential roost trees per acre.
  - Minimum requirement: 0.4 potential roost trees per acre.

**If a survey of the habitat within the project area finds that suitable summer habitat for the Indiana bat, as defined above, is present then there are two options available.**

### Option 1 -- Avoid the Problem.

- Allow roadside tree cutting between October 1 to March 31.
  - Potential roost trees may be removed during these dates.
- Prohibit roadside tree cutting between April 1 and September 30.

### Option 2

- Conduct a mist net survey of the project area for Indiana bats.
  - Survey period May 15 - August 31
  - Night temperature above 50°F
  - No precipitation
  - Wind - calm
  - Requires an open site: Do not net under a closed forest canopy
  - Requires overcast skies or less than ½ moon
  - Mist nets stacked at least 4 m (13 feet) high
  - Net set distance - 1 set per ½ mile of stream corridor or upland sites
  - Nets set 3 nights from sunset to at least 0200 hours
  - Nets to cover from ground or water surface to enclosing foliage or banks on sides
  - Nets must be checked every 20 minutes

SECTION 10 – THE INDIANA BAT

- No disturbance within 50 meters of the net sites
- A concurrent *Anabat* audio survey is recommended by the U.S. Fisheries & Wildlife Service.
  - A standardized protocol has yet to be devised for the *Anabat* audio survey.
- Submit survey results to the address below.
- The Iowa DNR will then provide a letter stating Effect or No Effect.
- If Indiana bats are found during the survey then no removal of the trees will be allowed between April 1 and September 30.

**Notes**

- Activities such as timber stand improvement that do not cut potential roost trees or fell other trees onto potential roost trees are not considered to cause harm to Indiana bats because of their short-term natural and limited disturbance.
- In some cases the girdling of trees 9 inches or larger can create potential roost trees, maintaining dead trees with loose bark and maintaining the diversity of tree species can be positive in providing roosting habitat for the Indiana bat.
- The Iowa DNR can offer assistance in identifying qualified professionals to conduct habitat surveys and bat surveys.
- Address questions and Survey Results to:

Iowa Department of Natural Resources  
Wallace State Office Building  
502 East Ninth Street  
Des Moines, Iowa 50319  
(Attention: Daryl Howell)  
515 281-8524.

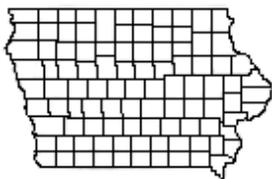
**Reminder**

The easiest way to avoid conflict with the Indiana bat is to prohibit roadside tree cutting between April 1 and September 30.

**References**

- Ayen, Jim. (United States Department of Agriculture/Natural Resources Conservation Service. Jim.Ayen@ia.usda.gov). Indiana bat range source requested [Internet]. Message to: Wade Williams (University of Northern Iowa Roadside Office. wade.williams@uni.edu). 2002 Aug 15. 8:15 am. [about 4 paragraphs].
- Howell Daryl. [Iowa DNR Letter Revised February 28, 2000]. Guidelines for protection of Indiana bat summer habitat. Located at: Iowa Department of Natural Resources, Wallace State Office Building, 502 East 9<sup>th</sup> Street, Des Moines, IA.
- McKenzie, Lynn. (U.S. Fish and Wildlife Service, Columbia, MO. (573) 876-1911). What is the area of concern in Iowa for the summer range of the Indiana bat? [Conversation]. From: Wade Williams (University of Northern Iowa Roadside Office. (563) 391-9392). 2002 Aug 14. 2 pm. [cited 2002 Aug 14]. [about 30 minutes].
- [Penn GC] Pennsylvania Game Commission. 2001. Indiana bat (*Myotis sodalis*). Harrisburg, PA:  
Penn GC. <[http://sites.state.pa.us/PA\\_Exec/PGC/bat/indiana/profile.htm](http://sites.state.pa.us/PA_Exec/PGC/bat/indiana/profile.htm)>. Accessed 2002 Jul 23.

## APPENDIX A – SURVEY



### 2002 IOWA COUNTY ROADSIDE TREE & BRUSH CONTROL SURVEY

Date:

County:

Position:

1. Verification: Are you the person that determines what methods are used in your county to manage roadside trees and brush?

1a. Can I have your name in case I have questions and need to call back?

Name

County

*Notice: Individual responses to the questions in this survey will be kept confidential except for an inventory of equipment used to cut brush for each county.*

1b. Are you interested in receiving a copy of the results of this survey?

Yes

No

1c. What is your mailing address?

1d. Telephone

1e. e-mail

1f. What is your position?

54 County Engineer

27 Roadside Manager

4 Assistant County Engineer

3 Roadside Manager / Weed Commissioner

2 Roadside Biologist

2 Weed Commissioner

1 Assistant County Engineer / Weed Commissioner

1 CCB Director & Weed Commissioner

1 Maintenance Foreman

1 Road Foreman

1 Road Superintendent

1 Roadside Biologist / Weed Commissioner

1 Roadside Manager / County Engineer

1 Roadside Manager / Superintendent of County Roads

1 Technician 4

1g. How long have you been in this position?

Average

<u>Years</u>	<u>Position</u>
25.0	Conservation Board Director
19.3	Assistant County Engineer
11.3	Road Foreman
9.9	Weed Commissioner
9.3	County Engineer
5.8	Roadside Manager

2. Who is responsible for the actual work involved with roadside tree and brush control in your county ?

57%	Secondary road maintenance crew
21%	Roadside Manager
11%	Private Contractor
11%	Other: IRVM seasonal or permanent staff; Weed Commissioner; County Engineer; Prison work release crew; Road Superintendent; Roadside Biologist; Utility companies.

2a. If Roadside Manger, where is he/she administratively located?

50%	In the secondary road department.
36%	Under the conservation board.
14%	A separate department.

3. Does your county have a written tree and brush removal policy?

22%	Yes
74%	No
4%	Don't know

The next 3 questions are rated on a scale of 1 to 6, with 6 being the highest.

4a. On a scale of 1 to 6, with 6 being highest, how satisfied are you with your ability to keep up with roadside tree and brush maintenance

(Low) 1..2..3..4..5..6 (High)  
Average = 3.62

4b. On a scale of 1 to 6, with 6 being highest, how satisfied are you with the quality of tree and brush maintenance of each roadside section

(Low) 1..2..3..4..5..6 (High)  
Average = 4.42

APPENDIX A – SURVEY

4c. On a scale of 1 to 6, with 6 being highest, how satisfied are you with your county's roadside tree and brush control program?

(Low) 1..2..3..4..5..6 (High)

Average = 3.95

5. What percentage of tree and brush control work is done by the roadside manager vs. the secondary road crew?

75% secondary road crew

20% roadside manager

4% private contractors

1% other: weed commissioner; utility crew; seasonal workers; prisoner work release; landowners

6. What percentage of your brush control is done by crews with chain saws?

Average = 47%

6a. On a scale of 1 to 6, with 6 being highest, how satisfied are you with this method?

(Low) 1..2..3..4..5..6 (High)

Average = 4.2

6b. What chain saws do you use?

Most Common Make

63% Stihl

10% Homelite

10% Husqvarna

6% Echo

3% John Deere

3% Poulan

3% Shindaiwa

1% Jonesrad

1% McCollough

Most Common Guide Bar Length

Average	Length (inches)
35%	16
21%	18
15%	20
12%	14
6%	24
6%	12
+ 6 other lengths, each at about 1%	

Most Common Model

31% Stihl 026

10% Stihl 021

8% Stihl 036

6% Stihl 029

+ 19 others, each at about 2%

7. What percentage of your brush control program is carried out with a boom mower?

(Do you use a boom mower?)

(50% yes)

(50% no)

Average = 36% (of those answering yes)

- 7a. On a scale of 1 to 6, with 6 being highest, how satisfied are you with this method?  
(Low) 1..2..3..4..5..6 (High)  
Average = 4.23  
Comments: See 3.11 *Boom Mowers* for a summary of comments.
- 7b. What boom mower do you use?  
Most common boom mower: Tiger TRB-50C  
Average head length 51.6"  
Average boom reach 20.6'  
Most common supporting tractor: John Deere 7410 tractor; MFWD optional (105 hp)  
Average power at PTO 91.5 hp (underpowered! (95-105 hp recommended)
8. What percentage of your brush control is carried out with foliar spray?  
(Do you use foliar spray?)  
(68% yes)  
(32% no )  
Average = 29% (of those answering yes)
- 8a. What product do you use?  
See Table 2 in Section 4 for a complete list.  
Fosamine ammonium, triclopyr and 2,4-D are the most common foliar control products used in Iowa.  
Metsulfuron-methyl becomes significant as a piggybacked product.  
Imazapyr is occasionally added to a metsulfuron-methyl + x triad.  
2,4-D provides broad-based support for other products when used in combination.
- 8b. On a scale of 1 to 6, with 6 being highest, how satisfied are you with this method?  
(Low) 1..2..3..4..5..6 (High)  
Average = 4.3  
Comments: See 4.3 *Foliar Spray* for a summary of comments.
9. What percentage of your brush control is carried out with basal bark treatment?  
(Do you use basal bark spray?)  
(21% yes)  
(79% no )  
Average = 7% (of those answering yes)
- 9a. What product do you use?  
See Table 4 in Section 4 for a complete list.  
Triclopyr is the most common basal bark product used in Iowa.

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- 9b. On a scale of 1 to 6, with 6 being highest, how satisfied are you with this method?  
(Low) 1..2..3..4..5..6 (High)  
Average = 4.3  
Comments: See 4.4 *Basal Bark Spray* for a summary of comments.
10. Do you treat cut stumps with herbicide?  
97% Yes  
3% No
- 10a. If yes: What percentage of stumps are you able to treat?  
Average = 87%
- 10b. What product do you use?  
See Table 6 in Section 4.5 for a complete list.  
Picloram + 2,4-D is the most common cut stump formulation used in Iowa.
- 10c. On a scale of 1 to 6, with 6 being highest, how satisfied are you with this method?  
(Low) 1..2..3..4..5..6 (High)  
Average = 4.34  
Comments: See 4.5 *Cut Stump Treatment* for a summary of comments.
11. Are you aware of any significant concerns about using chemical control in your county?  
63% Yes  
37% No
- 11a. If yes, have these concerns caused you to alter your spraying efforts?  
86% Yes  
14% No
- 11b. If yes, how?  
See 4.1 *Methods of Chemical Brush Control* for a summary of comments.
12. Do you use fire to manage roadside trees and brush?  
30% Yes  
70% No
- 12a. If yes, is it effective?  
90% Yes  
10% No
- 12b. Comment  
See Section 5 *Prescribed Burns* for a summary of comments.

13. Do you document tree and brush removal?

- 77% Yes
- 23% No

13a. If Yes, how?

- 41% Map (usually makes notes on a map & highlights work areas)
  - 30% Paper files, forms, journal, workbook
  - 13% Photography
    - Mostly before and after documentation in case of controversy.
    - Also has value for interpretive purposes.
  - 11% Employee time sheets or time cards.
  - 4% Keeps records on a computer; Uses GIS technology.
  - 1% Work order system
- Comment: See Section 7.5 *Documenting Work* for a summary of comments.

5. What other methods of roadside tree and brush control do you use that we have not already mentioned?

14a. What equipment do you use to accomplish these methods?

14b. What are the advantages of this/these methods?

- Hand cutting with loppers and bow saws. (Section 3.3)
  - 5 counties use this equipment.
  - It comprises about 25% of their brush control effort.
- String trimmers with brush blades. (Section 3.4)
  - 33 counties use this equipment.
  - It comprises a very small % of their brush control effort.
- Tree shears supported by excavators. (Section 3.6)
  - 4 counties own 5 tree shears.
  - It comprises 13% of their brush control effort.
- Excavator thumbs. (Section 3.7)
  - 6 counties own 8 thumbs
  - It comprises an unknown % of their brush control effort.
- Rotary grass mowers. (Section 3.8)
  - 18 counties report using these mowers to control brush.
  - It comprises about 13% of their brush control effort.
- Pole saws. (Section 3.9)
  - 22 counties report using this equipment.
  - It comprises an unknown % of their brush control effort.
- Aerial lift trucks & Chain Saws. (Section 3.10)
  - 4 counties report using a bucket truck.
  - It comprises about 5% of their brush control effort.
- Brush Cutters supported by excavators. (Section 3.12)
  - 15 counties own a total of 16 brush cutters.
  - Most common brush cutter: Weldco-Beales ERC48 Rotary Brush Cutter.
  - Most common supporting excavator: Caterpillar M318 Wheel Excavator

- The Limb Lopper. (Section 3.13)
  - The Limb Lopper is a prototype cutting shears used to prune high overhanging branches.
  - The cutting head attaches to an XL4100 Grade All Telescoop.
- Grubbing. (Section 3.14)
  - 10 counties grub plants on a regular basis.
  - It comprises about 13% of their brush control effort.
  - Equipment commonly used to grub out plants:
    - 58% Excavator
    - 26% Backhoe-Loader
    - 11% Loader
    - 5% Bulldozer
- Heavy Equipment. (Section 3.15)
  - 25 Counties use heavy equipment to control brush.
  - It comprises an average of 21% of their brush control effort.
  - There are 3 approaches to using heavy equipment:
    - 8% Restoring drainage takes an occasional tree.
    - 28% A means of last resort to control brush.
    - 64% A convenient method of brush control.
  - Equipment Used
    - 58% Bulldozer
    - 26% Excavator
    - 7% Motor Grater
    - + 3 other equipment types, each at about 3%
- Mechanical seeding. (Section 3.16)
  - 9 counties report using one or more types of reseeding equipment.
    - 35% broadcast seeder
    - 24% drill seeder
    - 24% hydroseeder
  - It comprises an unknown % of their brush control effort.

15. Can you summarize how your county integrates mechanical and chemical control of roadside trees and brush?

- Counties with light brush are heavily farmed. (Section 7.2)
  - Chain saws and foliar sprays are effective methods of brush control.
  - Many counties are on a rotational basis, with crews covering the entire county in one to several years.
- Counties with medium brush are in eastern and southeastern Iowa. (Section 7.3)
  - No single method works for controlling brush problems in any area.
- Counties with heavy brush are in northeast and southeast Iowa.
  - Boom mowers help crews are commonly used.
  - Crews can barely keep up with timber growth in heavily forested areas.

APPENDIX A – SURVEY

16. What percentage of roadside cut tree and brush is:  
27% Chipped (or mulched by mower) and left of the ground  
22% Burned on site  
21% Left in the ditch  
14% Chipped and hauled away  
+ 6 other methods, averaging about 3% each.
- 16a. What chipper do you use?  
Most Common Make  
50% Vermeer  
38% Morbark  
3% Badger  
3% Bandit  
1% M&M  
5% Unknown  
Average diameter log chipped = 10 inches  
Average diameter range = 6 to 12 inches
17. Do you notify landowners before cutting or spraying near their home?  
44% Yes  
8% Sometimes  
47% No  
Comment: See 7.6 *Getting the Public Involved* for a summary of comments.
18. What percent of landowners do some voluntary roadside tree and brush maintenance?  
Average = 15%
- 18a. Does this help you or create problems for you?  
78% of managers thought it helped.  
17% of managers thought it caused problems.  
4% of managers thought it had no effect at all.
- 18b. If helps, how?  
Landowners mow their ditches, which helps keep down weeds, brush & trees.
- 18c. If creates problems, what are they?  
• 38% Brush left behind in the ditch was a problem.  
• 21% No cut stump treatments produces sucker sprouting.  
• 12% Landscaping in the clear zone through selective cutting.  
• 12% Foliar spray problems.  
• 6% Other actions harm relict prairie plants.

APPENDIX A – SURVEY

19. Would you like to see landowners assume more responsibility for managing roadside tree and brush that is adjacent to their property?

- 78% Yes
- 22% No
- 1% No opinion

19a. If yes, what needs to be done in order to get the landowners more involved?

- 16% Said that land owners should be offered a tax incentive to do more tree and brush control.
- 16% Said that better communication and public education was needed with our office.
- 14% Were in favor of legislation to require landowners to control their own roadside brush. (3% were opposed to this idea.)
- 5% Were concerned about liability factors.

20. Over the past five years, has your budget for roadside tree and brush management?

- 60% Increased
- 0% Decreased
- 40% Stayed the same

21. Over the next five years, do you think your budget for roadside tree and brush management will?

- 32% Increase
- 16% Decrease
- 52% Stay the same

22. Is your current budget for tree and brush management sufficient to maintain roadsides to your level of satisfaction?

- 56% Yes
- 44% No

22a. If no, how much additional funding do you feel is necessary?

- Average = \$82,000
- Average = 150% of your current budget for tree & brush management

22b. How would you use the additional funding?

- 30% Hire more manpower/expand the staff/create new positions
- 29% Buy equipment or chemicals
- 10% Expand the spray program
- 9% Expand the current program but otherwise do things the same.
- 22% Other: contract more labor or spraying; put the county on a maintenance rotation; plant more native seed; conduct a roadside inventory; conduct a cost-effect analysis; improve public education; dedicate more heavy equipment.

APPENDIX A – SURVEY

23. Approximately, how much does your county spend each year on roadside tree and brush management?

Average = \$77,100

See Section 9 *Budget* for a summary of comments.

24. Do you feel the Iowa Code is helping or hindering the process of trying to maintain roadside trees and brush?

23% Helping

24% Hindering

3% Both

50% No Opinion

24a. If helping or hindering, why do you feel that way?

See Section 10 *Roadside Brush and the Iowa Code* for a summary of comments.

25. Is there anything you think I've left out that you would like to add?

We're hoping to have this survey completed by March 1. We'll send you a copy of the results when its finished. Thank you for helping me.

## APPENDIX B – COUNTY EQUIPMENT

**Table 1. Boom mowers and supporting tractors.**

County	Boom Mower*· **	Head (in)	Extends <sup>†</sup> (ft)	Tractor*	Horsepower at PTO
Allamakee	Alamo A-Boom & Boom Axe Head (2)	60	17	Ford-New Holland 6640 tractor	76
	***	**	**	John Deere 2750 tractor	73
Howard	Alamo Machete & Rotary Brush Head; rear mount.	60	24	Ford-New Holland 9030 bi-directional tractor	100
Jackson	Alamo A-Boom & Boom Axe Head	60	18	Ford-New Holland 7740 tractor	86
Polk	Alamo Machete & Machete Rotary Head (2)	60	24	John Deere 6410 tractor (2)	90
Linn	Alamo Machete & Rotary Brush Head	60	24	John Deere 7200 tractor	92
Poweshiek	Alamo Versa-Boom & unknown Mower Head	unk.	17	John Deere 2755 tractor	76
Cerro Gordo	Bomford B457 & 950 Brush Head; rear mount	48	15	John Deere 7210 tractor with MFWD	95
Butler	Bomford (Turner 25SX) Hydromower & Brush Flail Head; rear mount	60	25	John Deere 4230 tractor	100
Fremont	Diamond DB-50C	50	20	Ford-New Holland 6640 tractor	76
Delaware	Diamond DB-50C	50	20	John Deere 7210 tractor with MFWD	95
Monona	Diamond DB-50C	50	20	John Deere 7210 tractor with MFWD	95
O'Brien	Diamond DB-50C	50	20	Ford-New Holland 8360 tractor with MFWD	115
Warren	Diamond DB-50C	50	20	John Deere 4450 tractor	140
	Diamond DB-50C	50	20	John Deere 7210 tractor with MFWD	95
Tama	Diamond DB-60C (3)	60	20	John Deere 6310 tractor (3)	80
Keokuk	Hydro-Ax 520 brush head (no boom)	72	n/a	Hydro Ax 520 (4wd, articulated)	
Delaware	Terrain King 20 (Alamo) A-Boom & Boom Axe Head	50	21	Ford-New Holland 6610 tractor	72
Wapello	Tiger TBF-50C; converted to rotary	50	20	Case IH 5230 tractor	90
Adair	Tiger TRB-50C	50	20	John Deere 7210 tractor with MFWD	95
Appanoose	Tiger TRB-50C (2)	50	25	John Deere 7210 tractor (2)	95
Boone	Tiger TRB-50C	50	20	John Deere 6400 tractor with MFWD	85
Bremer	Tiger TRB-50C	50	23	Ford-New Holland 7740 tractor	86
Cedar	Tiger TRB-50C	50	20	John Deere 7200 tractor with MFWD	92
Clarke	Tiger TBF-50C	50	25	John Deere 6400 tractor	85
Clayton	Tiger TRB-50C	50	20	Ford-New Holland 6610 tractor	72
	Tiger TRB-50C	50	20	International Harvester 100 Hyrdo	104
Dallas	Tiger TRB-50C	50	20	John Deere 6410 tractor	90

APPENDIX B – COUNTY EQUIPMENT

**Table 1. Continued.**

County	Boom Mower* **	Head (in)	Extends <sup>†</sup> (ft)	Tractor**	Horsepower at PTO
Davis	Tiger TRB-50C	50	20	John Deere 4240 tractor	111
Decatur	Tiger TRB-50C	50	20	John Deere 7210 tractor	95
	Tiger TRB-50C	50	20	John Deere 7410 tractor	105
Dubuque	Tiger TRB-50C	50	20	John Deere 6400 tractor	85
Fremont	Tiger TRB-50C	50	20	John Deere 2755 tractor	76
Greene	Tiger TRB-50C	50	20	Ford-New Holland 6610 tractor	72
Harrison	Tiger TRB-50C	50	25	John Deere 6400 tractor	85
Keokuk	Tiger TRB-50C	50	20	Ford-New Holland 8260 tractor	100
	Simultaneously pulls a Schulte XH1000 Series 2 rotary mower				
Lee	Tiger TRB-50C	50	20	Ford-New Holland 7740 tractor	86
Lucas	Tiger TRB-50C	50	20	John Deere 7210 tractor	95
Madison	Tiger TRB-50C	50	20	John Deere 6410 tractor	90
Mahaska	Tiger TRB-50C	50	20	Case IH 5130 tractor	85
Marion	Tiger TRB-50C	50	20	John Deere 7210 tractor	95
Mills	Tiger TRB-50C	50	20	John Deere 7210 tractor	95
Mitchell	Tiger TRB-50C	50	20	Ford-New Holland 7710 tractor	87
Monroe	Tiger TRB-50C	50	25	John Deere 6400 tractor	85
Montgomery	Tiger TRB-50C	50	20	John Deere 6400 tractor	85
Page	Tiger TRB-50C	50	20	New Holland TS-110 tractor	100
Pottawattamie	Tiger TRB-50C (2)	50	20	John Deere 6410	85
	***	**	**	International Harvester 186 Hydro	105
Sac	Tiger TRB-50C	50	20	John Deere 7410 tractor with MFWD	105
Taylor	Tiger TRB-50C (2)	50	20	Ford-New Holland 6610 tractor (2)	72
Union	Tiger TRB-50C	50	20	John Deere 2755 tractor	76
Wapello	Tiger TRB-50C	50	20	Case IH 5120 tractor	77
	Tiger TRB-50C	50	25	John Deere 7210 tractor	95
Wayne	Tiger TRB-50A	50	20	John Deere 6400 tractor	85
Winneshiek	Tiger TRB-50C	50	20	John Deere 6410 tractor with MFWD	90
Worth	Tiger TRB-50 (2)	50	20	Ford-New Holland 7710 tractor (2)	87

APPENDIX B – COUNTY EQUIPMENT

**Table 1. Continued.**

<b>County</b>	<b>Boom Mower* **</b>	<b>Head (in)</b>	<b>Extends<sup>†</sup> (ft)</b>	<b>Tractor**</b>	<b>Horsepower at PTO</b>
Iowa	Tiger TRB-60C	60	20	John Deere 6400 tractor	85
Jackson	Tiger TRB-60C (2)	60	20	John Deere 6400 tractor (2)	85
Lyon	Tiger TRB-60C	60	20	Ford-New Holland 6610 tractor	72
Washington	Tiger Boom, custom Weldco-Beales brush cutter head ERC-42?	42	20	John Deere 7400 tractor	100

\*Boom Mower mid mount unless otherwise noted.

\*\*Quantity 1 unless otherwise noted in parenthesis.

<sup>†</sup>Extension as measured from the tractor centerline; mount configuration changes these numbers somewhat.

APPENDIX B – COUNTY EQUIPMENT

**Table 2. Brush cutters and supporting excavators.**

County	Brush Cutter*	Head (in)	Extends (ft) <sup>†</sup>	Excavator*
Davis	Alamo Grizzly G52D (aka Pro Mac 52CMP)	52	25	John Deere 595D wheel excavator
Monona	Bear BBM Supercut 2	60	23	Caterpillar 140G motor grater
Floyd	Gregory/Roanoke MG-20 (aka G-195B)	60	20	Caterpillar 12E motor grater
Tama	Gregory/Roanoke CH-55 (2)	66	20	Gradall G660E wheel hydraulic excavator
	***	**	20	Gradall XL4100 wheel hydraulic excavator
Adair	Pro Mac 52A	52	20	John Deere 595D wheel excavator
Madison	Pro Mac 52CMP	52	35	Caterpillar 320B L track excavator
Van Buren	Pro Mac 52CMP	52	33	Daewoo Solar 200W-III wheel excavator
Story	Pro Mac 52CMP series 2	52	28	Daewoo DH200W wheel excavator
Wayne	Seppi M. BMS125	49	35	Caterpillar 325B L tracked excavator
Clayton	Wag Way Bird Eye 1000	44	33	Daewoo Solar 200W-III wheel excavator
Poweshiek	Weldco-Beales ERC36	36	25	Caterpillar 214B FT wheel excavator
Washington	Weldco-Beales ERC36	36	30	Caterpillar 315C tracked excavator
Allamakee	Weldco-Beales ERC48	48	35	Caterpillar 322B L track excavator
Buena Vista	Weldco-Beales ERC48	48	31	Caterpillar M318 wheel excavator
Guthrie	Weldco-Beales ERF48	48	20	Badger 1085C wheel excavator
Marshall	Weldco-Beales ERC48	48	31	Caterpillar M318 wheel excavator
Sac	Weldco-Beales ERC48	48	31	Caterpillar M318 wheel excavator

\*Quantity 1 unless otherwise noted in parenthesis.

<sup>†</sup>Extension as measured from the tractor centerline; mount configuration changes these numbers somewhat.

**Table 3. Tree shears and supporting excavators.**

County	Shear	Jaws (in)	Grapple	Accumulator	Reach <sup>†</sup> (ft)	Excavator
Monona	Agra Axe	14	no	no	20	John Deere 595D tire excavator
	New Dymax 16" Forestry Tree Shears	16	yes	no	25	Caterpillar 214B FT tire excavator
Buchanan	New Dymax 14" Forestry Tree Shears	14	yes	no	31	Caterpillar M318 tire excavator
Page	New Dymax 18" Forestry Tree Shears	18	yes	no	35	Caterpillar 320B L track excavator
Taylor	New Dymax 18" Forestry Tree Shears	18	yes	no	35	Caterpillar 320B L track excavator

<sup>†</sup>Extension as measured from the tractor centerline; mount configuration changes these numbers somewhat.

APPENDIX B – COUNTY EQUIPMENT

**Table 4. Excavator thumbs and supporting excavators.**

County	Thumb	Type	Reach <sup>†</sup> (ft)	Excavator
Clayton	Wag Way Bird Eye	Hydraulic	33	Daewoo Solar 200W-III wheel excavator
Guthrie	FLCO (2)	Hydraulic	33	Sampson SL210 track excavator (2)
Jasper	New Dymax	Manual	35	Caterpillar 322B L track excavator
	New Dymax	Manual	35	Caterpillar 325B L track excavator
Wright	Empire Bucket	Manual	35	Caterpillar 320B L track excavator
Buchanan	In house from sketches.	Manual	35	John Deere 200C LC track excavator
Woodbury	Pemberton 501M	Manual	35	John Deere 200 LC track excavator

<sup>†</sup>Extension as measured from the tractor centerline; mount configuration changes these numbers somewhat.

APPENDIX B – COUNTY EQUIPMENT

**Table 5. Equipment used to grub out trees.**

Percent	County	Equipment
40	Woodbury	backhoe-loader, model unknown
25	Johnson	excavator, track Case 9030 (2) excavator, track Case 9050
20	Montgomery	excavator, track John Deere 690
10	Cass	excavator, tire Grade-All XL 4100 Telescoop (2)
10	Emmet	chain saws backhoe-loader, tire Case 580SK loader, tire Caterpillar 950G loader, tire Caterpillar 966E
5	Audubon	excavator, track John Deere 690L track excavator, track Badger 1085C
5	Boone	backhoe-loader, tire Caterpillar 420D
1	Humboldt	backhoe-loader, tire John Deere 310C-4WD backhoe-loader, tire Case 580 super L
trace	Lyon	bulldozer, track Caterpillar D6H
blank	Mahaska	chain saws excavator, tire John Deere 595D excavator, tire Gradeall G660 Telescoop excavator, Link-Belt, track LS 2800 excavator, track Caterpillar 320B L

\*Quantity 1 unless otherwise noted in parenthesis.

APPENDIX B – COUNTY EQUIPMENT

**Table 6. Rotary grass mowers (used for brush control) and supporting tractors.**

<b>County</b>	<b>Rotary Grass Mower*</b>	<b>Head (in)</b>	<b>Tractor*</b>	<b>Horsepower at PTO</b>
Allamakee	Tiger TRR-132C twin rotary mower (Tiger TM-72C side rotary mower) (Tiger TRR-60C rear rotary mower)	132 (72) (60)	John Deere 7210 tractor with MFWD	95
Appanoose	Tiger TRR-120C twin rotary mower (4) *** (Tiger TM-60C side rotary mower) (Tiger TRR-60C rear rotary mower)	120 *** (60) (60)	John Deere 6400 tractor (2) John Deere 2755 tractor (2)	85 76
Boone	Tiger TRR-120C twin rotary mower (3)	120	John Deere 6400 tractor (3)	85
Cherokee	Schulte XH1500 batwing mower	180	Case IH MX100C tractor with MFD	85
Clarke	Tiger TM-60C side rotary mower (3) ***	60 ***	John Deere 6300 tractor (2) John Deere 6310 tractor	75 80
Decatur	Alamo VM60 side rotary mower	60	John Deere 2755 tractor	76
	Tiger TM-60C side rotary mower (3)	60	John Deere 6400 tractor (2)	85
	Alamo BD80 rear rotary mower (3)	80		
Des Moines	Tiger TRR-120C twin rotary mower	120	John Deere 7410 tractor	105
Fayette	Schulte XH1500 batwing mower	180	International Harvester 856 tractor	101
Floyd	Alamo VM60 side rotary mower	60	Agco Allis 7600 tractor	89
	Bush Hog 278-OR rear rotary mower	96		
	Tiger TM-60C side rotary mower	60	John Deere 2755 tractor	76
Hardin	Alamo SHD88 side flail mower	60	John Deere 2755 tractor	76
	Alamo VM72 rear rotary mower	72		
	Alamo VM72 side rotary mower	72	John Deere 2555 tractor	65
	Bush Hog 307-OR rear rotary mower	72		
Humboldt	Tiger TRR-120C twin rotary (4) ***	120 ***	John Deere 7710 tractor (2) Ford-New Holland 2955 tractor (2)	130 86
	Bush Hog 2615 Legend flexwing rear rotary mower	180	John Deere 6400 tractor with MFWD	85
Jasper	John Deere 1580 flexwing rear rotary cutter	180	Ford New Holland 7740 fwd	86
Johnson	Alamo Hydro 15 batwing (6) ***	180 ***	John Deere 6400 tractor (2) John Deere 6410 tractor (2)	85 90
	***	***	John Deere 6420 tractor (2)	90

APPENDIX B – COUNTY EQUIPMENT

**Table 6. (Cont)**

<b>County</b>	<b>Rotary Grass Mower*</b>	<b>Head (in)</b>	<b>Tractor*</b>	<b>Horsepower at PTO</b>
Jones	Tiger TRF-90 side rotary mower (6)	90	Ford-New Holland 5600 tractor (2)	63
	Tiger TRR-60C rear rotary mower	60		
	Tiger TRF-102C rear rotary mower (2)	102		
	***	***	Ford-New Holland 5610 tractor	66
	***	***	Ford-New Holland 7610 tractor	90
	***	***	Ford-New Holland 7710 tractor	87
	***	***	Ford-New Holland 7740 tractor	86
Keokuk	Tiger TRR-120C twin rotary mower	120	John Deere 2955 tractor	86
Ringgold	Tiger TM-60C side rotary mower (2)	60	Ford 6600 tractor	71
	***	***	Ford 6610 tractor	72
	Bush Hog 2615 Legend flexwing rotary mower (2)	180	Case IH 5140 tractor	
	***	***	Case IH 5230 tractor with MFD	
Wayne	Bush Hog 3610 single wing rotary mower	126	Ford 7700 tractor	84
	Bush Hog 2615 Legend flexwing rotary mower	180	Case IH MX135 tractor with MFD	
	Tiger TRR-120C twin rotary mower (2)	120	John Deere 6400 tractor (2)	85
Webster	Alamo VM60 side rotary mower	60	John Deere 2555 diesel tractor	65
	Southern SC50MD rear rotary mower	50		

\*Quantity 1 unless otherwise noted in parenthesis.

†Extension as measured from the tractor centerline; mount configuration changes these numbers somewhat.

## APPENDIX C – EXTENT OF FOREST COVER IN IOWA\*

\*Iowa Department of Natural Resources, 1988 GIS Data (unpublished)

**Table 1. Data by County**

County	Forest Acres	% Land Forested	County	Forest Acres	% Land Forested
Adair	6,990	1.9	Jefferson	38,149	13.7
Adams	9,420	3.5	Johnson	47,047	11.8
Allamakee	143,664	34.1	Jones	45,391	12.3
Appanoose	45,210	13.7	Keokuk	35,016	9.4
Audubon	2,337	0.8	Kossuth	10,153	1.6
Benton	20,404	4.4	Lee	82,211	23.9
Black Hawk	18,173	5	Linn	53,517	11.5
Boone	22,874	6.2	Louisa	39,965	15
Bremer	17,590	6.3	Lucas	38,483	13.9
Buchanan	15,265	4.2	Lyon	2,542	0.7
Buena Vista	6,346	1.7	Madison	26,992	7.5
Butler	12,261	3.3	Mahaska	22,272	6.1
Calhoun	1,807	0.5	Marion	39,249	10.8
Carroll	2,685	0.7	Marshall	12,840	3.5
Cass	6,086	1.7	Mills	14,218	5
Cedar	25,205	6.8	Mitchell	9,025	3
Cerro Gordo	13,184	3.6	Monona	23,143	5.2
Cherokee	12,535	3.4	Monroe	51,418	18.5
Chickasaw	11,858	3.7	Montgomery	7,480	2.7
Clarke	25,621	9.3	Muscatine	37,704	13.1
Clay	10,552	2.9	O'Brien	5,375	1.5
Clayton	138,097	27.2	Osceola	1,268	0.5
Clinton	41,056	9	Page	11,832	3.5
Crawford	5,341	1.2	Palo Alto	6,671	1.8
Dallas	22,322	5.9	Plymouth	7,790	1.4
Davis	49,061	15.2	Pocahontas	3,962	1.1
Decatur	43,286	12.7	Polk	33,899	9
Delaware	31,619	8.5	Pottawattamie	19,471	3.2
Des Moines	55,051	20	Poweshiek	10,888	2.9
Dickinson	6,077	2.4	Ringgold	29,039	8.4
Dubuque	74,271	18.8	Sac	3,303	0.9
Emmet	7,434	2.9	Scott	28,818	9.6
Fayette	44,200	9.4	Shelby	2,912	0.8
Floyd	9,283	2.9	Sioux	2,877	0.6
Franklin	10,246	2.8	Story	11,558	3.2
Fremont	17,351	5.2	Tama	27,818	6
Greene	7,259	2	Taylor	19,549	5.7
Grundy	1,796	0.6	Union	15,026	5.5
Guthrie	21,227	5.6	Van Buren	73,169	23.3
Hamilton	10,634	2.9	Wapello	46,830	16.8
Hancock	7,151	2	Warren	37,112	10.1
Hardin	14,449	4	Washington	36,879	10.1
Harrison	23,700	5.3	Wayne	20,481	6.1
Henry	42,761	15.3	Webster	22,479	4.9
Howard	7,935	2.6	Winnebago	6,168	2.4
Humboldt	6,370	2.3	Winneshiek	59,215	13.4
Ida	2,487	0.9	Woodbury	17,717	3.2
Iowa	31,755	8.5	Worth	9,151	3.6
Jackson	96,305	23.2	Wright	10,173	2.7
Jasper	20,767	4.4			

**Table 2. Ranked Data.**

Rank	County	% Land Forested	Rank	County	% Land Forested
<b>Heavy Brush Cover</b>			48	Mills	5.0
1	Allamakee	34.1		Black Hawk	5.0
2	Clayton	27.2	50	Webster	4.9
3	Lee	23.9	51	Benton	4.4
4	Van Buren	23.3		Jasper	4.4
5	Jackson	23.2	53	Buchanan	4.2
6	Des Moines	20.0	54	Hardin	4.0
7	Dubuque	18.8	55	Chickasaw	3.7
8	Monroe	18.5	56	Cerro Gordo	3.6
9	Wapello	16.8		Worth	3.6
10	Henry	15.3	58	Marshall	3.5
11	Davis	15.2		Adams	3.5
12	Louisa	15.0		Page	3.5
<b>Medium Brush Cover</b>			61	Cherokee	3.4
13	Lucas	13.9	62	Butler	3.3
14	Appanoose	13.7	63	Pottawattamie	3.2
	Jefferson	13.7		Woodbury	3.2
16	Winneshiek	13.4		Story	3.2
17	Muscatine	13.1	66	Mitchell	3.0
18	Decatur	12.7	67	Poweshiek	2.9
19	Jones	12.3		Floyd	2.9
20	Johnson	11.8		Emmet	2.9
21	Linn	11.5		Clay	2.9
22	Marion	10.8		Hamilton	2.9
23	Warren	10.1	72	Franklin	2.8
	Washington	10.1	73	Montgomery	2.7
25	Scott	9.6		Wright	2.7
26	Fayette	9.4	75	Howard	2.6
	Keokuk	9.4	76	Winnebago	2.4
28	Clarke	9.3		Dickinson	2.4
29	Clinton	9.0	78	Humboldt	2.3
	Polk	9.0	79	Greene	2.0
31	Delaware	8.5		Hancock	2.0
	Iowa	8.5	81	Adair	1.9
33	Ringgold	8.4	82	Palo Alto	1.8
34	Madison	7.5	83	Buena Vista	1.7
35	Cedar	6.8		Cass	1.7
<b>Light Brush Cover</b>			85	Kossuth	1.6
36	Bremer	6.3	86	O'Brien	1.5
37	Boone	6.2	87	Plymouth	1.4
38	Wayne	6.1	88	Crawford	1.2
	Mahaska	6.1	89	Pocahontas	1.1
40	Tama	6.0	90	Ida	0.9
41	Dallas	5.9		Sac	0.9
42	Taylor	5.7	92	Audubon	0.8
43	Guthrie	5.6		Shelby	0.8
44	Union	5.5	94	Carroll	0.7
45	Harrison	5.3		Lyon	0.7
46	Fremont	5.2	96	Sioux	0.6
	Monona	5.2		Grundy	0.6
			98	Osceola	0.5
				Calhoun	0.5

**APPENDIX D – RECORD KEEPING**

**1.  
DOCUMENTING HERBICIDE APPLICATION**

PESTICIDE APPLICATION RECORD  
MUSCATINE COUNTY

PESTICIDES APPLIED FOR: Muscatine County Highway Department  
3600 Park Avenue West, Muscatine, IA 52761  
Phone 319-263-6351  
Certification No. PO 00306 000

Certified Applicator: Bruce Bryant  
Certification No. 01378  
Phone: Home 319-264-5243  
Work 319-263-6351

Pesticide Use: Right of Way

Pest Controlled brush – cut stumps – basal bark

		Morning	Afternoon
Date	_____	_____	_____
Time	_____	_____	_____
	Temperature	_____	_____

Soil Conditions \_\_\_\_\_

Pesticides Used Pathfinder II

Active Ingredient: triclopy 3,5,6 - trichloro - 2- pyridinyloxyacetic acid,  
butoxyethyl ester

EPA Registration Number 62719-176

Restricted Use: Yes No

Pesticide Mixture straight

Amount of Pesticide Applied \_\_\_\_\_

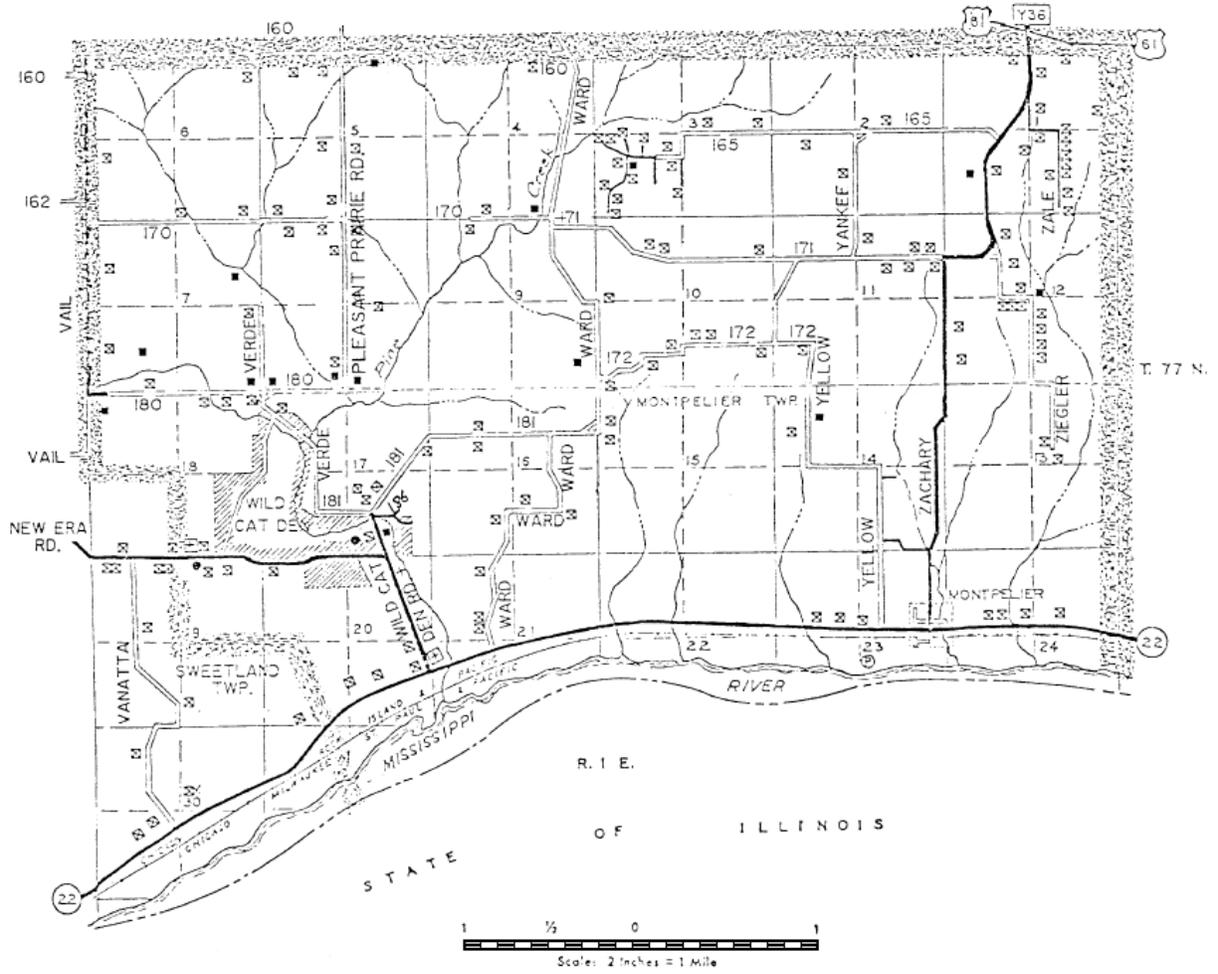
Location: Township \_\_\_\_\_

T \_\_\_\_\_ R \_\_\_\_\_ Section \_\_\_\_\_ 1/4 Section \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

SEE ATTACHED MAP

APPENDIX D – RECORD KEEPING

Muscatine County – Montpelier and Sweetland Townships



2.

**DOCUMENTING INTEGRATED VEGETATION MANAGEMENT**

**BREMER COUNTY HIGHWAY DEPARTMENT**

Begins Sunday, 12:01 AM  
Ends Saturday, 12:00 PM

Month	Day	Year

Employee Name \_\_\_\_\_  
Employee Number \_\_\_\_\_

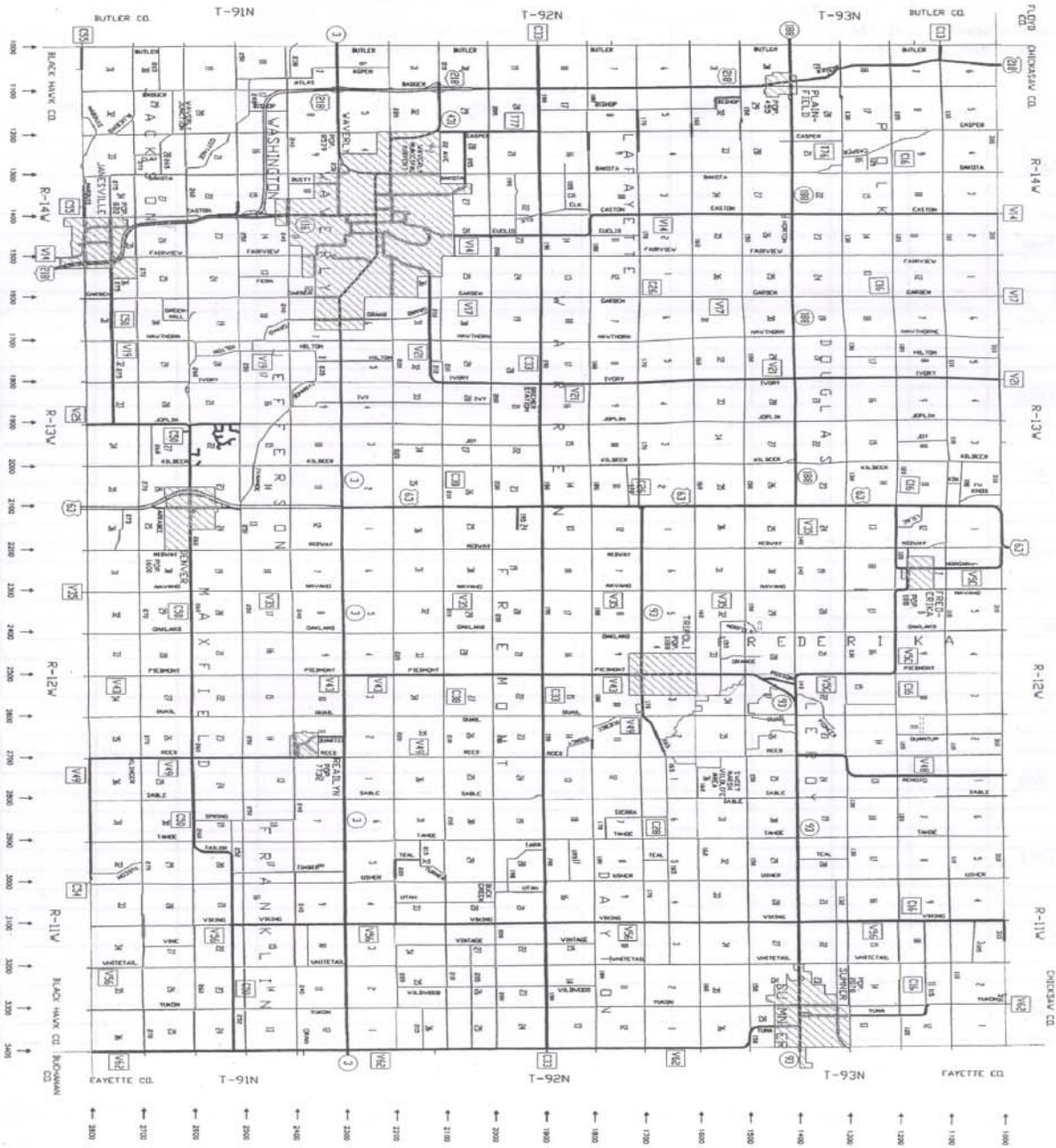
Date	Time		DOT Code	Hours		Location Description Project, Bridge, Culvert #	Equipment No.	Hours	Miles
	In	Out		Regular	Overtime				
Sun									
Mon									
Tues									
Wed									
Thurs									
Fri									
Sat									
Sun									
Mon									
Tues									
Wed									
Thurs									
Fri									
Sat									

I hereby certify that the amounts given on this time sheet are correct.

Employee \_\_\_\_\_ Date \_\_\_\_\_ Supervisor \_\_\_\_\_ Date \_\_\_\_\_

Approved \_\_\_\_\_ Date \_\_\_\_\_

APPENDIX D – RECORD KEEPING



**DOT CODING**

**ENGINEERING**

212 Assistants

250 Bridge Inspection

**NEW CONSTRUCTION**

320 Bridges

331 Pipe Culverts

332 Box Culverts

**Roadway Construction**

351 Clearing & Grubbing

352 Excavation/Entrances

**Surfaces**

361 Granular Surfacing

362 Stabilized Granular

364 Seal Coat

366 Asphalt Concrete

**Roadside Construction**

382 Erosion Control

383 Shouldering

**Traffic Control**

391 Signs

394 Guardrail

**MAINTENANCE**

420 Bridges

431 Pipe Culverts

432 Box Culverts

**Roadway Maintenance**

451 Blading Granular

459 Miscellaneous

**Surface Maintenance**

461 Granular Surfacing

464 Seal Coat

466 Asphalt Concrete

467 P. C. Concrete

**Roadside Maintenance**

481 Ditch Cleaning

482 Shoulder Repair

483 Erosion Control

484 Entrances

485 Tile Lines

**Road Clearing**

491 Brush Cutting

492 Spraying-Weed Control

493 Mowing

**Snow & Ice Control**

521 Plow - Salt - Sand

522 Plowing Only

523 Salt or Sand only

524 Materials

525 Snow Fences

526 Snow Equipment

**Traffic Controls**

591 Sign Maintenance

594 Guardrail

**EQUIPMENT OPERATIONS**

610 Modifying New

622 Equipment Repair

624 Servicing Equipment

625 Safety Equipment

650 Cleaning, Upkeep of shop, mowing lawn

692 Unload Supplies

820 Buildings

**TIME OFF**

903 Vacation

904 Sick

905 Holiday

910 Funeral

911 Personal

**COLOR CODING**

**FIRST WEEK**

Sunday Purple

Monday Red

Tuesday Green

Wednesday Yellow

Thursday Blue

Friday Orange

Saturday Brown

**SECOND WEEK**

-----

**Map Coding (in Detail)**

**ENGINEERING**

- 212 Assistants
- 250 Bridge Inspection

**NEW CONSTRUCTION**

- 320 Bridges
- 331 Pipe Culverts
- 332 Box Culverts
- Roadway Construction
- 351 Clearing and Grubbing
- 352 Excavation/Entrances
- Surfaces
- 361 Granular Surfacing
- 362 Stabilized Granular
- 364 Seal Coat
- 366 Asphalt Concrete
- Roadside Construction
- 382 Erosion Control
- 383 Shouldering
- Traffic Control
- 391 Signs
- 394 Guardrail

**MAINTENANCE**

- 420 Bridges
- 431 Pipe Culverts
- 432 Box Culverts
- Roadway Maintenance
- 451 Blading Granular
- 459 Miscellaneous
- Surface Maintenance
- 461 Granular Surfacing
- 463 Dust Control
- 464 Seal Coat
- 466 Asphalt Concrete
- 467 P.C. Concrete
- Roadside Maintenance
- 481 Ditch Cleaning
- 482 Shoulder Repairs
- 483 Erosion Control
- 484 Entrances
- 485 Tile Lines

Road Clearing

- 491 Brush Cutting
- 492 Spray-Weed Control
- 493 Mowing
- Snow & Ice Control
- 521 Plow - Salt - Sand
- 522 Plowing Only
- 523 Salt or Sand Only
- 524 Materials
- 525 Snow Fences
- 526 Snow Equipment
- Mount or Removal
- Traffic Controls
- 591 Sign Maintenance
- 594 Guardrail

**EQUIPMENT OPERATIONS**

- 610 Modifying New
- 622 Equipment Repair
- 624 Servicing Equipment
- 625 Safety Equipment
- 650 Cleaning, Upkeep of Shop, Mowing Lawn
- 692 Unload Supplies
- 820 Buildings

**TIME OFF**

- 903 Vacation
- 904 Sick
- 905 Holiday
- 910 Funeral
- 911 Personal

**COLOR CODING**

FIRST WEEK	SECOND WEEK
_____	//////////
Sunday	Purple
Monday	Red
Tuesday	Green
Wednesday	Yellow
Thursday	Blue
Friday	Orange
Saturday	Brown

APPENDIX E – ROADSIDE WORK PUBLIC RELATIONS FORM



**Conservation Board  
Cerro Gordo County**

3501 Lime Creek Road      Mason City, Iowa 50401-9256      (641) 423-5309  
Board Members: Gene Hinrichs, Steve Karabotsos, Dr. Ron Masters, Jim Roseland, Fred Younger,  
Fred Heinz, Director.

ROADSIDE MANAGEMENT REQUEST FORM

Date: \_\_\_\_\_

Persons' Name: \_\_\_\_\_

Phone Number: \_\_\_\_\_ Address: \_\_\_\_\_

Please check box if you would like to be notified when the project is done.

Type of Request: (circle one)

- Brush
- Mowing
- Seeding
- Weeds
- Other \_\_\_\_\_

Describe request: \_\_\_\_\_  
\_\_\_\_\_

Exact location of the site (using new rural addressing system):  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Date Request was addressed: \_\_\_\_\_

Notations: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## APPENDIX F – BRUSH CONTROL POLICY

### JOHNSON COUNTY BRUSH CONTROL POLICY Johnson County, Iowa

This policy addresses the procedures and methods for the proactive management of woody vegetation adjacent to roads under the jurisdiction of the Johnson County Board of Supervisors. It is the duty of the Board of Supervisors and the Johnson County Secondary Road Department to maintain a county road system that is reasonably safe and convenient for public travel, and to manage roadside resources with an eye toward preservation of beneficial plant communities. In 1990, Johnson County adopted an Integrated Roadside Vegetation Management Plan to address these needs. Johnson County's Roadside Vegetation Management Program has and will continue to make progress toward providing a safe, low maintenance roadside using approved management techniques. In accepting responsibility for the roadway, Johnson County recognizes that even the most skilled and cautious driver is subject to errors or situations which may cause a vehicle to stray from the road surface. The recovery area allows for such situations and can allow vehicles to reenter the road surface without experiencing severe damage. Within financial and practicable limits, it is the Johnson County Secondary Road Department's intent to provide a road system that is reasonably safe and forgiving of human error. The number one concern for a brush removal policy is safety for the traveling and general public.

For the purposes of this policy, the traveled way is that portion of the road used for the movement of vehicles, exclusive of shoulders. The roadside is that portion maintained for safety and public convenience beyond the traveled way.

The roadside serves many purposes. Some of these purposes are to provide for:

- a space to escape or avoid accidents;
- a space for improved sight distance;
- a space for maintenance activities such as snow removal and storage;
- an area which allows for road drainage;
- areas to plant and manage prairie species for tree, weed and erosion control;
- areas for overhead and buried utility services;
- an area of valuable wildlife habitat;
- an area for attempted preservation of existing native plant communities.

Johnson County's Integrated Roadside Vegetation Management Program uses several management techniques to meet all of these purposes and to provide a safe and environmentally sound roadway.

#### RIGHT OF WAY AREAS TO BE TREATED

For the good of public safety and the traveling public, the right-of-way must be managed to reduce accident severity and to increase driver visibility. The majority of roads within Johnson County have a 66ft right of way. Generally the traveled portion of the road (road surface) is approximately 25 feet wide, which leaves 20.5 feet of area on either side for maintenance and management activities. If not managed for the reasons above, brush and trees can take over the shoulder areas, encroach onto the traveled surface, obstruct driver vision, increase icing hazards, and impact the safety and convenience of the motoring public. In addition, brush growing too close to the road tends to cause snow-drifting problems in the winter, leads to root invasion and road surface heaving, and drainage pattern changes from diverted channels, which encourages erosion. Overgrowth of limbs and brush invoke a response from motorists to cross the centerline to avoid paint scraping and other damage to vehicles.

Tree and brush management priority shall be by road system, with the primary roads having the highest priority. Management priority shall be asphalt or concrete mats (paved), oil and chip seal roads, granular surface roads (gravel), and lastly, Level B Maintenance roads (dirt), in that order. The Johnson County Engineer or designee shall decide the degree of hazard exposure priority.

There are certain conditions within the Right of Way in which brush or trees present **clear hazards**. In these situations, the brush and trees which are in close proximity to the road surface must be removed. Trees within the right-of-way, but greater than 30 feet from the road surface present **reduced hazard** and may be considered individually.

Areas in which brush and trees must be managed to promote safety:

- 1). All brush and trees on the foreslope and ditch bottom must be removed
- 2). Brush at intersections must be removed to a minimum distance of 350 ft. to provide visibility of hazards or oncoming vehicles.
- 3). Brush must be removed around traffic warning signs to a minimum distance of 350 feet, allowing viewing at typical road speeds.
- 4). Brush on inside horizontal curves must be removed at points obscuring driver vision.
- 5). Brush on outside horizontal curves and trees in a target position for errant vehicles must be removed.
- 6). Trees and limbs overhanging road surfaces, creating icing or snow drifting hazards, providing too little vertical or horizontal clearance, or which cause a vehicle to move out of the proper lane must be either **pruned** or **removed**.

Trees/brush will also be considered for removal in these instances: Accident frequency (evidence of vehicle/tree accident) either from actual reports or scarring. Also to be considered for removal are problem species which encourage the spread of disease or which have been designated by USDA (United States Department of Agriculture)/IDALS (Iowa Department of Agriculture and Land Stewardship) or Johnson County, as invasive, noxious, or undesirable. If the following conditions exist within the right-of-way, it may be possible to retain trees that would otherwise be considered for removal:

- 1). Species are designated as Endangered or Threatened as defined by state or federal listings.
- 2). Trees are behind nontraversable backslopes or banks.

## APPENDIX F – BRUSH CONTROL POLICY

- 3). Trees are behind guardrails, providing a minimum of 4 feet of clearance from guardrail to tree.
- 4). Trees within the right-of-way are greater than 30 feet from the traveled portion of the road.
- 5). Brush removal would adversely affect wetlands or water quality.

Approved tree or shrub species, which, when located on the backslope, and are not causing drifting, icing, visibility problems, or other road hazards, should be left for wildlife habitat. A list of approved tree or shrub species is attached as Appendix A. Situations will be inspected individually by the Johnson County Engineer or designee. This guideline is subordinate to any federal or state requirements associated with road projects constructed to current engineering design standards.

### TREATMENT METHODS

Johnson County will provide regular training on various brush and tree control methods to employees. Training will be on topics such as: traffic and equipment safety, tree and plant identification, safe and correct use of herbicide application equipment and products, proper pruning techniques, IRVM fundamentals (i.e. prescribed burning, prairie planting, etc.), seeding and mowing techniques. The County is committed to providing education to employees about right-of-way vegetation management and ways to improve roadsides. Training will be conducted by the Roadside Vegetation Manager or by using appropriate training professionals.

**Mechanical-** Physical removal of trees and brush with large equipment (excavators, bulldozers, etc.), or hand cut with chain saws, etc. Brush control may be either by mechanical means or hand cutting consistent with the physical and cost restraints of limited equipment, time, personnel, and funds for this purpose. Naturally occurring remnant prairies will have brush removed by hand. Reconstructed prairies will be subject to listed management methods, with the goal of avoiding disturbance to beneficial plant communities.

**Mowing-** Mowing of small trees or brush and chemically treating stumps (when practical) to prevent resprouting. This may entail mowing of foreslope, ditch bottom, or backslope, which are infested with brush and small trees. Ditch bottom and backslope mowing will take place primarily in the late summer through early spring, with the exception of brush in locations causing road hazards. Brush on backslopes will be mowed when it is in appropriate safe zones, as defined by this policy.

**Prescribed Burning-** Using controlled fire to stunt or kill small brush species and to prevent woody encroachment into remnant or established prairie locations. This is generally not effective on larger trees (i.e. >2-3 inches diameter).

**Chemical-** Using a spot herbicide application program with IRVM goals to control small brush within the right-of-way. The spot application is designed to target specific problem species to avoid disturbance to more beneficial plant communities. The herbicides used will be only those approved by appropriate state and federal agencies for this purpose and in this location. All applicators shall receive annual training on herbicide use and safety, and plant identification. Herbicides shall be applied only by state licensed and properly trained or supervised personnel, using appropriate equipment, and shall be applied in a timely fashion, with the intent of killing, or significantly retarding, woody plant growth. This includes cut stump, frill, basal bark, and limited foliar applications. Foliar applications shall be limited to spot spraying of small individual brush in problem locations. No blanket foliar spraying will be done. Foliar applications will only be used in areas where other treatment methods are ineffective. No foliar application for woody species control will be done in naturally occurring remnant prairies. A Roadside Maintenance Agreement, available from the Roadside Vegetation Manager, allows the property owner to manage vegetation within the right-of-way adjacent to their property without the use of spot herbicide applications. Vegetation must be maintained in accordance with Johnson County Brush Control and Noxious Weed Policies. The property owner may request this annual Agreement which explains the property owner's responsibility in order to avoid the spot herbicide application. Organic producers, beekeepers, etc. are encouraged to obtain Roadside Maintenance Agreements, and post Official County signs at property borders.

**Competitive Seeding-** Planting of native prairie vegetation or other hardy perennial plants, where feasible, to help control encroaching brush and weeds, and to reduce long-term area maintenance costs. This method shall be used in large brush removal areas as time and funds permit.

**Tree Pruning-** The purpose of tree pruning is twofold. The primary purpose is to remove limbs necessary to obtain appropriate horizontal and vertical roadside recovery area (above the road and roadside), and to preserve or extend the life of the tree. Tree pruning shall also take place to increase sunlight onto the road surface to aid in snow melt. Trees shall be pruned to obtain a minimum of 25 feet vertical clearance. This allows taller vehicles, such as school buses, farm equipment, or dump trucks to use the road without damage to the vehicle or tree. If possible, and where feasible, trees in front of dwellings shall be pruned to increase horizontal and vertical clearance, rather than direct removal. Brush which is growing close to the road, where the driver feels they must move out of their lane to avoid it, must be removed or pruned. Trees which originate from private property and overhang the roadway shall be pruned back to the right-of-way line using accepted arboricultural practices, where feasible. The secondary purpose of pruning is to remove dead, dying, or weakened tree limbs, which, in the opinion of the County Engineer or designee, present a hazard.

**Stump Removal-** Where trees exceeding six inches in diameter are removed, the remaining stump shall not exceed four inches above ground level. Stump removal for other than hazardously positioned trees should be considered lower priority than tree removal or pruning, but it is the intent that stumps shall be flush cut and treated with herbicide to prevent regrowth.

## APPENDIX F – BRUSH CONTROL POLICY

### TREE AND SHRUB PLANTINGS

Trees or shrubs shall not be planted or allowed to grow in the right-of-way within 30 feet of the traveled portion of a public road. Existing trees or shrub plantings adjacent to a home or dwelling which have been planted in close proximity to the roadway, or are causing a vision problem, i.e. inside curves, intersections, or are causing a snow drifting or icing problem, will be removed. Landowners shall have the option to transplant these trees or shrubs, at their expense, out of the public right-of-way adjacent to their property. Landowners shall be notified to remove these trees or undesirable vegetation, with 30 days to complete the work (unless otherwise specified). This gives the landowner ample time to move the trees or vegetation to a more desirable location. If, after 30 days, the work has not been satisfactorily completed, a follow up letter will be sent, specifying the removal will be done by Secondary Roads when conditions permit. Tree and shrub species planted as part of the Adopt-A-Roadway Program landscaping section shall not exceed 4 inches in stem diameter at maturity. A list of these approved species is attached as Appendix A, and all species must be approved by the Roadside Vegetation Manager prior to planting. No tree or shrub species will be planted in naturally occurring remnant or reconstructed prairies.

### OTHER CONSIDERATIONS

An ongoing inventory of roadside vegetation resources and problems will be developed in order to facilitate better management. The inventory will contain information on prairie locations, areas of tree and brush infestations, noxious weed infestations, etc. This inventory process can help to identify areas which need special consideration and treatment, as well as problem areas which need attention. This inventorying process will also help to identify and protect naturally occurring remnant plant communities.

Trees/limbs within the right-of-way which are diseased/dead and could fall onto the roadway shall be removed. Trees which fall off of private property onto the roadway will be removed/trimmed within the borders of the public right-of-way. Trees which fall off the public right-of-way onto private land will be removed by the County. The County assumes no liability for damages caused by, or removal of, said trees.

Brush and trees removed within the right-of-way will be handled differently depending on situation and location. Brush will be either: chipped into roadside, chipped and hauled away, left in roadside, buried, hauled away, or burned. Low impact control methods shall be used, if possible, in areas of naturally occurring native plant communities including prairies, savanna, and wetlands.

This policy is proposed because of the need to address woody plant species within the County right-of-way. There is a clear need to have a set policy in regards to tree and brush removal, which is based on public safety, and sound environmental management practices. Using Integrated Roadside Vegetation Management to provide a proactive approach to brush and tree management is both publicly and environmentally friendly. Additionally, using several management tools for woody plant species control gives the IRVM program the flexibility needed to provide Johnson County with a safe and attractive roadside, along with improved wildlife habitat and erosion control.

### JOHNSON COUNTY APPROVED SHRUB LIST AS OF 08-31-00

This list is a work in progress of trees and shrubs which are considered suitable within the right-of-way in the locations set forth in the Johnson County Brush Control Policy. This list is not all-inclusive, and may be edited to include or remove certain species as conditions or situations dictate. Emphasis will be placed on using native plant species with mature stem diameter of 4 inches or less. The Johnson County Engineer or designee should approve corrections or additions to this list.

### APPROVED NATIVE SHRUB SPECIES

Allegheny Blackberry	<i>Rubus alleghaniensis</i>
American Black Currant	<i>Ribes americanum</i>
American Bladdernut	<i>Staphylea trifolia</i>
American Elder	<i>Sambucus canadensis</i>
American Hazelnut	<i>Corylus americana</i>
Atlantic Leatherwood	<i>Dirca palustris</i>
American Plum	<i>Prunus americana</i>
Beaked Filbert	<i>Corylus cornuta</i>
Black Haw	<i>Viburnum prunifolium</i>
Black Raspberry	<i>Rubus occidentalis</i>
Black Chokeberry	<i>Aronia melanocarpa</i>
Buffalo Currant	<i>Ribes odoratum</i>
Bunchberry Dogwood	<i>Cornus canadensis</i>
Canada Yew	<i>Taxus canadensis</i>
Carolina Rose	<i>Rosa carolina</i>
Common Buttonbush	<i>Cephalanthus occidentalis</i>
Common Juniper	<i>Juniperus communis</i>
Common Ninebark	<i>Physocarpus opulifolius</i>
Common Snowberry	<i>Symphoricarpos albus</i>
Cranberrybush Viburnum	<i>Viburnum trilobum</i>
Creeping Juniper	<i>Juniperus horizontalis</i>
Dwarf Bush Honeysuckle	<i>Diervilla lonicera</i>

APPENDIX F – BRUSH CONTROL POLICY

Dwarf Chinkapin Oak	<i>Quercus prinoides</i>
Dwarf Wild Indigo	<i>Amorpha nana</i>
Early Wild Rose	<i>Rosa blanda</i>
Fragrant Sumac	<i>Rhus aromatica</i>
Gray Dogwood	<i>Cornus racemosa</i>
Hortulan Plum	<i>Prunus hortulana</i>
Indiangrass Coralberry	<i>Symphoricarpos orbiculatus</i>
Indigo Bush	<i>Amorpha fruticosa</i>
Juneberry	<i>Amelanchier alnifolia</i>
Leadplant	<i>Amorpha canescens</i>
Long-beaked Willow	<i>Salix bebbiana</i>
Low-bush Blueberry	<i>Vaccinium angustifolium</i>
Missouri Gooseberry	<i>Ribes missouriense</i>
Meadowsweet Spirea	<i>Spiraea alba</i>
Mountain Alder	<i>Alnus incana</i>
Nannyberry	<i>Viburnum lentago</i>
Northern Arrowwood	<i>Viburnum molle</i>
New Jersey Tea	<i>Ceanothus americanus</i>
Pagoda Dogwood	<i>Cornus alternifolia</i>
Prairie Crabapple	<i>Malus ioensis</i>
Prairie Rose	<i>Rosa setigera</i>
Prairie Willow	<i>Salix humilus</i>
Prickly Gooseberry	<i>Ribes cynosbati</i>
Pussy Willow	<i>Salix discolor</i>
Redbud	<i>Cercis canadensis</i>
Red Raspberry	<i>Rubus strigosus</i>
Red-osier Dogwood	<i>Cornus stolonifera</i>
Rough-leaved Dogwood	<i>Cornus drummondii</i>
Sand Cherry	<i>Prunus pumila</i>
Scarlet Elder	<i>Sambucus pubens</i>
Serviceberry	<i>Amelanchier arborea</i>
Shining Willow	<i>Salix lucida</i>
Shrubby St. Johnswort	<i>Hypericum prolificum</i>
Silky Dogwood	<i>Cornus anomum</i>
Silver Buffaloberry	<i>Sheperdia argentea</i>
Smooth Sumac	<i>Rhus glabra</i>
Staghorn Sumac	<i>Rhus typhina</i>
Wafer Ash	<i>Ptelea trifoliata</i>
Wahoo	<i>Euonymus atropurpurea</i>
Winterberry	<i>Ilex verticillata</i>
Witch Hazel	<i>Hamamelis virginiana</i>

**ACCEPTABLE NON-NATIVE SHRUB SPECIES**

These species are included as horticultural possibilities for private landowners and will not normally be planted by Johnson County.

Bottlebrush buckeye	<i>Aesculus parviflora</i>
Bridalwreath Spirea	<i>Spiraea prunifolia</i>
Bush Cinquefoil (Potentilla)	<i>Potentilla fruticosa</i>
Flowering Almond	<i>Prunus triloba</i>
Forsythia	<i>Forsythia spp.</i>
Hydrangea	<i>Hydrangea arborescens</i>
Lilac	<i>Syringa vulgaris</i>
Mock Orange	<i>Philadelphus pubescens</i>
Nanking Cherry	<i>Prunus tomentosa</i>
Northern Bayberry	<i>Myrica pennsylvanica</i>
Potentilla	<i>Potentilla fruticosa</i>
Rose of Sharon	<i>Hibiscus syriacus</i>
Rugosa Rose	<i>Rosa rugosa</i>
Spicebush	<i>Lindera benzoin</i>
Weigelia	<i>Weigelia florida</i>

## APPENDIX F – BRUSH CONTROL POLICY

### UNACCEPTABLE SHRUB SPECIES

A list of unacceptable plant species is included below. Plant species which occur on this list are considered invasive or noxious, and are unsuitable for use within the right-of-way. This list is subject to additions or corrections, as more information and growth characteristics become available.

Autumn Olive	<i>Elaeagnus umbellata</i>
Barberry	<i>Berberis thunbergii</i>
Burning Bush	<i>Euonymus alatus</i>
Buckthorn	<i>Rhamnus species (All)</i>
Honeysuckle	<i>Lonicera species including japonica, tatarica; mackii; etc.</i>
Multiflora Rose	<i>Rosa multiflora</i>
Russian Olive	<i>Elaeagnus angustifolia</i>

### References

Johnson County, Iowa. 2002. Johnson County Brush Control Policy. In: Johnson County Secondary Roads [Webpage]. Iowa City, Iowa. Via the Internet: <[www.johnson-county.com/secondaryroads/pdf/brushcontrolpolicy.pdf](http://www.johnson-county.com/secondaryroads/pdf/brushcontrolpolicy.pdf)>. Visited 2002 Apr 11.

## APPENDIX G – LEGAL OPINIONS

### 1. CARSTENSEN V. CLINTON COUNTY

Carl P. Carstensen, Appellant,  
v.  
CLINTON COUNTY, Iowa, the Board of  
Supervisors of Clinton County, Iowa.  
Adolph Wieck, Chairman, William H.  
Kroymann and John Camp, Appellees.  
No. 49620

Supreme Court of Iowa  
February 10, 1959.

Action by farmer to enjoin county board of supervisors from cutting down or injuring 16 large evergreen trees in front of his farmyard, orchard and feed lot and along a federal-aid secondary road which was being widened and improved. The Clinton District Court, Arthur F. Janssen, J., entered judgement for defendant, and the plaintiff appealed. The Supreme Court, Oliver, J., held that evidence sustained finding that the trees materially obstructed the highway or interfered with its improvement of maintenance.

Affirmed.

#### 1. Eminent Domain 300

In farmer's action to enjoin county board of supervisors from cutting down or injuring 16 large evergreen trees in front of his farmyard, orchard and feed lot and along a federal-aid secondary road which was being widened and improved, evidence sustained finding that the trees materially obstructed the highway or interfered with its improvement or maintenance. I.C.A. 306.21, 314.7, 471.4, subd. 1.

#### 2. Appeal and Error 1008(1)

Findings of fact of trial court are entitled to substantial weight.

W.R. Mockridge, De Witt, for appellant.

L.L. Jurgemeyer, Clinton for appellees.

OLIVER, Justice.

This is an appeal by plaintiff landowner from a judgement of Clinton District Court denying his petition to enjoin the Board of Supervisors from cutting down or injuring 16 large evergreen trees in front of his farmyard, orchard and feed lot in front of his farm. This road runs from De Witt north about 12 miles, connects two primary highways and carries much traffic which is expected to substantially increase with its improvement. The part of it which abuts plaintiff's farm, runs straight north and south for approximately five miles and is called the Humeston Road.

It had been a 66 foot road but the Board had adopted plans for its reconstruction which called for an increase in the width of the traveled portion, berms and ditches, and required that the width of the right of way be increased to 86 feet. This was done by procuring a strip 10 feet wide along each side of the original right of way. The trees here in question are in and along the strip on the east side of the road for a distance of 238 feet. The plans of the Humeston project called for a crushed rock surface to be subsequently covered with asphalt. At the time of the trial the project had been completed except for the ditch, etc., along this 238 feet on the east side of the roadway, and the road was open for travel.

Humeston Road is what is known as a federal-aid-secondary road, the plans for reconstruction of which require approval by the State Highway Commission, which has established certain minimum standards conforming to those fixed by the Bureau of Public Roads. The disagreement over the trees had arisen when the Board sought to secure from plaintiff the ten foot strip of land for additional right of way. Plaintiff testified he told the Board, "if they would leave the trees . . . I would move my fences and give them the ground without compensation. They didn't think they could leave the trees because they were afraid the State Highway wouldn't approve it." Thereafter, at plaintiff's request, the State Highway Commission sent an engineer to inspect the trees. Apparently his report resulted in the disapproval by the Highway Commission feared by the Board.

[1] In September, 1956, defendant Board prepared to remove the trees. Plaintiff then instituted this suit and was granted a temporary restraining order forbidding such removal. Trial of the case resulted in judgement for defendants and this appeal therefrom by plaintiff. Upon appeal plaintiff relies upon section 314.7, Code of Iowa, 1954 (1958) which states in part:

"Officers, employees, and contractors in charge of improvement or maintenance work on any highway shall not cut down or injure any tree growing by the wayside which does not materially obstruct the highway, or tile drains, or interfere with the improvement or maintenance of the road, and which stands in front of any town lot, farmyard orchard, or feed lot, or any ground reserved for any public use."

Error is predicated upon the finding of the court that the trees materially obstructed the highway or interfered with the improvement or maintenance of the road, and the failure to find their destruction would violate Code section 314.7, I.C.A.

Three experienced highway engineers testified for defendants concerning various technical and practical aspects of the reconstruction plans. One of them testified that in the winter season plaintiff's trees would tend to cause snow to pile up on the roadway and, during the morning hours, their

## APPENDIX G – LEGAL OPINIONS

shade would lessen the thawing of snow and ice thereon. In his cross-examination one such witness was asked whether in designing a roadway he would take into consideration the Iowa statute (Code section 314.7, I.C.A.) for the protection of trees by the wayside. He answered, “Well, sometimes it is impossible to do so to arrive at what you ultimately want to build.” He testified also, “Well, if we adhere strictly to the question of law there are probably certain shoulder widths and things like that, but those are absolute minimums. They were not out here building the road to serve a few people. We are trying to build a higher type of road, and I don’t think those apply.” He stated that the trees interfered with the improvement and maintenance of the road and obstructed the ditch.

Another highway engineer testified: “I consider shoulders, foreslope, and ditch bottom and backslope as part of the road. I don’t believe the foreslope, bottom and backslope can be built to satisfactory specifications with his trees remaining standing. A width of six feet or more for the ditch bottom is desirable from the standpoint of safety, the holding of snow, construction and maintenance.”

The trial court found from the evidence, “that Defendant’ plans and specifications for the improvement of that portion of the highway bordering on Plaintiff’s farm conform to the general plan for the improvement of the entire highway and that said plans are those accepted by qualified engineers experience in highway construction. They call for an asphaltic concrete surface 22 feet wide placed on a rolled stone base, 26 feet 3 inches in width located on subgrade 30 feet in width. The plans also provide for a 2 to 1 foreslope, a ditch with a six-foot bottom and a 1 to 1½ backslope.

“In the formation of the plans, which require an additional ten feet on each side of the existing right of way, such factors as safety for the driving public, soil context, drainage of surface water, and maintenance work were taken into consideration.”

There is nothing in the record from which the Court may find that the plans and specifications are in error to achieve the improvement of the road as intended.

“The evidence shows that if the trees with their overhanging branches are to remain the driver of a modern car entering from plaintiff’s drive upon the thirty-foot highway when completed will be unable to view approaching traffic at a safe distance without driving his car forward to a position which will place the front bumper of the car approximately 2½ feet upon the thirty-foot surface of the highway. This situation will constitute a hazard to users of the highway and Plaintiff’s drive.

“The Court further finds that if the trees were permitted to stand in their present condition that the overhang of lower limbs would materially interfere with the operation of standard road equipment employed to construct the drainage ditch and gutter slopes. The branches under discussion will likewise interfere with future maintenance of the ditch and gutter slopes in question.”

- [2] The findings of fact of the distinguished trial court are entitled to substantial weight and the record persuades us they are correct. There is no substantial controversy over the basic legal proposition and most of the authorities cited appear in both briefs. Code sections 306.21 and 471.4, subd. 1, I.A.C., empower Boards of Supervisors to widen secondary roads and to take such private properties as are reasonable and necessary for that purpose.

The decision here most nearly in point is *Rabiner v. Humboldt County*, 1938, 224 Iowa 1190, 1194, 1196, 1197. 278 N.W. 612, 614, 116 A.L.R. 89, which considered a statute similar to section 314.7, Code of Iowa, 1954 (1958), I.A.C. That decision states:

“... We find that the conclusion of the county authorities that the highway could not be up graded and improved to make a standard road except by the removal of the trees is sustained by the record and we may no substitute our judgement for theirs.’

“... It is a well known-fact of which the Court should take judicial notice that in recent years and at this time, the officers of the State have been and are working to establish and construct a general system of highways of a permanent, uniform and standard character. The requirements of the public in the use of highways are such that it commands a different construction than was required or considered necessary thirty years ago. And we must keep pace with those new conditions and new requirements. The convenience of the individuals must give way to these demands and requirements of the general public ...”

This decision was followed by *Harrison v. Hamilton County*, 1939, 284 N.W. 456, not reported in Iowa Reports. Other Iowa decisions cited on this point are *Bills v. Belknap*, 1873, 36 Iowa 583; *Crimson v. Deck*, 1892, 84 Iowa 344, 51 N.W. 55, both of which proceeded the era of modern highways and are of little assistance here.

Plaintiff’s determined effort to save his magnificent trees is not criticized. However, his position cannot be maintained against the interests of the general public. The judgement of the trial court is affirmed.

Affirmed.

All justices concur.

## 2. HARRISON V. HAMILTON COUNTY

HARRISON v. HAMILTON COUNTY et al.  
No. 44595.

Supreme Court of Iowa  
March 7, 1939

### 1. Highways [West Key Number System 83]

In landowner's suit to enjoin destruction of trees in building of highway, evidence authorized destruction of trees on ground that trees materially interfered with improvement of the road by obstructing drainage. Code 1935, §4644-c46.

### 2. Appeal and Error [West Key Number System 655(4)]

An amended additional abstract of testimony, filed without leave of court after appellees' argument was filed and three days before submission of the case, would be stricken on motion.

\*\*\*\*\*

Appeal from District Court, Hamilton County; O.J. Henderson, Judge.

Defendants were about to improve the one-half mile of highway along the west side of plaintiff's 160 acre farm. Plaintiff brought this suit to enjoin defendants from cutting down seven trees and some shrubbery which were in the highway. The trial court dismissed the petition. Plaintiff appealed.

Affirmed

R.G. Remley, of Webster City, for appellant.

Geo. B. Aden, of Webster City, for appellees.

STIGER, Justice.

Plaintiff alleged in his petition that he was the owner of certain real estate in Webster Township, Hamilton County, Iowa; that defendants threatened to destroy trees constituting a windbreak situated in front of his premises and to destroy and remove this fence on the west side of his quarter section and prayed that defendants be enjoined from destroying or removing said trees and from removing his west line fence on said quarter section.

The trial court found for the defendants, dismissed plaintiff's petition and restrained plaintiff from interfering with the construction and improvement of the one-half mile of highway adjoining his land on the west.

The west line of plaintiff's farm is adjacent to a north and south highway established 66 feet wide. Only 44 feet of the highway had been appropriated for highway purposes. Plaintiff's west line fence is in the highway about 15 feet west of his west line. The 7 trees, which are the subject matter of this litigation and are in the highway, consist of 4 native cedar trees, 2 of which are not over 10 feet high, 2 soft maples and a willow tree. The trees are too far apart to form an effective windbreak.

Beginning at the north west corner of appellant's property, the road is comparatively level south to his driveway and from that point to the south side of his farm, there is a down grade of about 6 feet to the 100. There is a culvert in the road near the south end of the farm over a ravine or gully. This one-half mile of road is a flat-top, dirt highway with inadequate drainage, subject to overflow at the south end and is impassable in wet weather. It is apparent that a large amount of dirt will be needed in the construction of this improvement.

The highway is in the construction program for the secondary road system of Hamilton County and when completed will be an all-weather highway, 66 feet wide and the trees will be substantially in the center of the drainage ditch along the east side of the highway.

Code Section 4644-c46 provides that officers, employees, and contractors in charge of secondary road construction and maintenance work shall not cut down or injure any tree growing by the wayside which does not "materially interfere with the improvement of the road". 284 N.W. – 29½

The sole question for determination here is whether the trees materially interfered with the improvement of the road. It is necessary that the road be constructed in a manner that would meet the requirements of the highway commission before it is graveled.

The County Engineer and the District Engineer for the highway commission testified at length about the details of the proposed improvement, the substance of their testimony being that the trees interfered with proper drainage and with obtaining sufficient dirt for the necessary fills, especially near the south end of the proposed improvement and if the trees were not removed the grade would have to be moved to the west and additional land purchased on the west side of the road. Both witnesses testified that the trees materially interfered with the improvement of the highway.

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The District Engineer testified that “in my opinion it would require the full 33 feet on the east side of the center line to meet with the minimum standard specification , a standard cut and fill section, which would necessitate the removal of the trees.”

Two witnesses for the plaintiff testified that it would not be practical to leave the trees in the highway unless the traveled portion was moved to the west. Plaintiff concedes in his argument that in order to build an all-weather secondary road it is necessary to utilize the entire 66 feet, but contends that because of the fairly steep down grade, the trees would not interfere with the drainage and that sufficient dirt for the fills could be obtained elsewhere along the highway.

- [1] The great weight of the evidence is with the defendants and especially sustains the claim of the defendants that the trees, unless removed, will prevent adequate drainage, and obtaining sufficient dirt for the construction of the highway, and we agree with the following finding of the trial court: “The sole remaining question, therefore, is whether or not they will ‘materially interfere with the improvement of the road.’ On this point the testimony is singularly in unison. A long procession of witnesses for the defendants, both expert and non-expert – including the engineer in charge of the improvement, and as well, the District Engineer of the State Highway Commission – agree that in order to build the necessary grade with the required lateral ditches along both its sides, the entire road width of 66 feet will need to be cleared and utilized throughout the length of the strip in question. Indeed plaintiff’s own witnesses, of whom there were a number, all but agreed that his is necessarily so.”

For a recent case on the question involved here, see *Rabiner v. Humboldt county, Iowa*, 278 N.W. 612, 116 A.L.R. 89.

- [2] Defendants’ motion to strike appellant’s amended additional abstract of the testimony, filed without leave of the court after appellees’ argument was filed and three days prior to the submission of the case, is sustained. Defendants’ motion to strike appellant’s reply brief and argument is overruled.

The case is affirmed.

Affirmed.

MITCHELL, C.J., and SAGER, RICHARDS, HALE, HAMILTON, MILLER, and OLIVER, J.J., CONCUR.

### 3. 1932 REPORT OF THE ATTORNEY GENERAL OF IOWA

#### Opinion pp. 93-94

BOARD OF SUPERVISORS – ROADS AND HIGHWAYS: Expense of destroying noxious weeds specified in section 1, chapter 111 laws of the forty-fourth general assembly should be paid by the county from the secondary road maintenance fund.

July 29, 1931. *County Attorney, Fort Dodge, Iowa*: This will acknowledge receipt of your letter of recent date requesting the opinion of this Department upon the following question:

“Are the costs of the destruction of noxious weeds under section 4819 code as amended by section 1, chapter 111, laws of the forty-fourth general assembly to be paid by the abutting land owners, or by the county, and if by the county from what fund?”

We are of the opinion that under this section as amended, the cost of destroying these weeds cannot be assessed to the abutting property owner since the act specifically places the responsibility for destroying such weeds upon the board of supervisors on the roads under their control.

We are also of the opinion that this cost should be paid from the secondary road maintenance fund as the destruction of these weeds under the present statute, is in fact, a part of the maintenance of the road. The work can best be done by those who are already maintaining the roads and the purpose of the legislature in placing this responsibility upon the county was in the interest of road maintenance rather than in the interest of the prevention of the spread of the weeds. Otherwise the responsibility would have been left on the adjoining property owner.

## APPENDIX H – LITERATURE SEARCH

### Law

Bloch L. 2000. Tree law cases in the USA. Potomac, MD: Bloch Consulting Group. 128 p.

Merullo VD, Valentine MJ. 1992. Arboriculture & the law. Champaign, IL: International Society of Arboriculture. 110 p.

Vance JC. 1986. Liability of state for injury or damage occurring in motor vehicle accident caused by trees, shrubbery, or other vegetative obstruction located in right-of-way or growing on adjacent private property. Washington, D.C.: Transportation Research Board, National Research Council. 19 p.

### State Plans & Manuals

#### Alaska

Johnson LA. 1995. Managing roadside vegetation in Alaska: Final report. Juneau, AK: Alaska Department of Transp and Public Facilities. Report nr INE/TRC 94.27, SPR-UAF-92-11. 27 p.

#### Arizona

[ADOTRRC] Arizona Department of Transportation Roadside Review Committee. 1989. Arizona's roadside vegetation management program. Public Works 120(3):66-70.

#### Arkansas

Klingaman GL, King JW, project leaders. 1994. Recommended species for roadside management. Little Rock, AR: Arkansas State Highway and Transportation Department. 228 p.

#### California

Jones and Stokes, preparers. 1991. Draft environmental impact report on Caltrans' vegetation control program: prepared for California Department of Transportation, Division of Maintenance. Sacramento, CA: Jones & Stokes. 1 v.

#### Colorado

Kohlhepp PF, Sanders TG, Tackett CC, Walters RW. 1995. Roadside vegetation management final guidelines document for the Colorado Department of Transportation's maintenance manual. Report nr CDOT-R-CSU-96-5, Study nr 230.03. 143 p.

#### Indiana

[INDOT] Indiana Department of Transportation. 2000. New treatment combinations for vegetation management along Indiana roadsides. Phase II. Final Report. West Lafayette IN: Purdue University, Indiana Department of Transportation JTRP. Report nr FHWA/IN/JTRP-2000/17. 43 p.

Morre DJ. 1995. New treatment combinations for control of brush and vegetation management along Indiana roadsides. Final report. Indianapolis, IN: Indiana Department of Transportation. Report nr FHWA/IN/JHRP-95/3, Project nr C-36-48M. Period covered 8907-9506. 122 p.

#### Iowa

[ARVSC] Alternative Roadside Vegetation Steering Committee... [et al.] 1989. Integrated roadside vegetation: policies for planting and management. Des Moines, IA: Legislative Service Bureau, General Assembly of Iowa. 1 v.

#### Minnesota

[MNDOT] Minnesota Department of Transportation. 1999. Woody & herbaceous plants for Minnesota landscapes & roadsides [computer file]: Minnesota department of transportation expert system for selecting landscape plants for versions of Microsoft Windows (Win95, Win98, Wand). St. Paul, MN: Minnesota Department of Transportation. CD-ROM.

[MNDOT] Minnesota Department of Transportation for Celebrate Minnesota 1990. 1988 Action plan: roadside native vegetation survey: preservation and management. MN: MNDOT. 14 p.

Walvatne P. 1996. How MNDOT handles IRVM training. Better Roads 66(10):18-20.

#### Oklahoma

Martin DL, Cargill LM, Montgomery DP. 1996. Roadside vegetation management. Oklahoma City, OK: Oklahoma Department of Transportation. Report nr FHWA/ODOT 96-05. Final report nr MP-138. Rept nr AG-91-EX-037. Period covered 9112-9609. 249 p.

## APPENDIX H – LITERATURE SEARCH

Martin DL, Cargill LM, Montgomery DP. 1991. Roadside vegetation management. Final report. Oklahoma City, OK: Oklahoma Department of Transportation. Report nr FHWA/OK 91(10). Report nr 86-03-03. Period covered 8607-9106. 135 p.

Martin DL, Cargill LM, Montgomery DP. 1996. Roadside vegetation management: final report for the period December 1991 to September 1996. Stillwater, OK: Department of Horticulture and Landscape Architecture, Oklahoma State University. 121 p.

### **Pennsylvania**

Herbert CC Jr, et al. 1987. Roadside vegetation management manual. Harrisburg, PA: Pennsylvania Department of Transportation. 120 p.

Herbert CC Jr, et al. 1987. Roadside vegetation research report. Harrisburg, PA: Pennsylvania Department of Transportation. 55 p.

Kilareski WP, Brydia RE, Lewis VP. 1994. Maintenance practices for local roads. Volume I: Maintenance techniques. Harrisburg, PA: Pennsylvania Department of Transportation. Report nr FHWA/PA 94-0200, PADOT Res Proj SS-051. 282 p.

### **Tennessee**

Lambdin PL, Grant JF. 2000. Assessment of exotic and invasive plants along roadways in Tennessee. Nashville, TN: Tennessee Department of Transportation. 155 p.

### **Texas**

Buffington, JL. 1987. Mowing, herbicide spraying and litter pickup cost comparisons. Volume II. Final report. College Station, TX: Texas Transportation Institute. Report nr FHWA/TX-87/380-1F, II. Research report nr 380-1F, II, TTI: 2-18-380-1F, II. Period covered 850900-8708. 76 p.

Meyer RE, Benner CL, McCully WG. 1995. Management of vegetation on the pavement edge and adjacent shoulder. College Station, TX: Texas Transportation Institute, Texas A&M University System. Report nr 902-12. Sponsored by the Texas Department of Transportation, Research and Technology Transfer Office in cooperation with the Federal Highway Administration under contract no. 7-902. 28 p.

Meyer RE, Benner CL, McCully WG. 1995. Management of vegetation on the pavement edge and adjacent shoulder. Interim report. College Station, TX: Texas Transportation Insistute. Report nrs Res Rept 902-12, TTI: 7-902, TX-95/902-12. Period covered 9106-9501. 44 p.

Meyer RE, Motteram ES, Evans SG, McCully WG. 1993. Controlling forest encroachment along east Texas roadways: interim report. College Station, TX: Texas Transportation Institute. Report nr Res Rept 902-8, TTI: 7-902, TX-94/902-8. Period covered 9110-9312. 32 p.

Schutt JR, McFalls J. 1996. Recommendations for an integrated weed management program for ornamental plantings on Texas highways. Austin, TX: Texas Department of Transportation. Final Report nr TX-97/2970-1F. Period covered 9509-9611. 100 p.

### **Washington**

Hamilton CW, Bell R, Giblin D, Wolf K, Ewing K. 1998. Planting for sustainable roadsides: empirical and experimental studies and recommendations for western Washington. Olympia, WA: Washington State Department of Transportation; Washington, D.C.: Federal Highway Administration. Research report nr WA-RD 439.1. 304 p.

### **Wisconsin**

[WOHM] Wisconsin Office of Highway Maintenance. 1990. Roadside vegetation management policy. Draft ed. Madison, WI: Wisconsin Department of Transportation, Division of Highways and Transportation Services, Bureau of Engineering Operations, Office of Highway Maintenance. 83 p.

### **Federal**

[NRC] National Research Council. 1993. Issues surrounding highway and roadside safety management. Transportation research record nr 416. Washington, D.C.: Transportation Research Board, National Research Council. 103 p.

[NRC]. 1992. Development and evaluation of roadside safety features. Washington, D.C.: Transportation Research Board, National Research Council National Academy Press. 101 p.

[NRC 1]. 1989. Winter maintenance, roadside management, and rating routine maintenance activities. Transportation research record nr 1246. Washington, D.C.: Transportation Research Board, National Research Council. 64 p.

[NRC 2]. 1989. Maintenance planning and managing roadside vegetation. Transportation research record nr 1189. Washington, D.C.: Transportation Research Board, National Research Council. 86 p.

## APPENDIX H – LITERATURE SEARCH

- [NRC]. 1987. Innovation, winter maintenance, and roadside management. Transportation research record nr 1127. Washington, D.C.: Transportation Research Board, National Research Council. 82 p.
- [NRC]. 1986. Roadside design and management. Transportation research record nr 1075. Washington, D.C.: Transportation Research Board, National Research Council. 48 p.
- [NRC]. 1985. The Roadside environment. Transportation research record nr 1016. Washington, D.C.: Transportation Research Board, National Research Council. 27 p.
- [TTC] Technology Transfer Center, Iowa State University. 1992? Vegetation control for safety a guide for street and highway maintenance personnel. Washington, D.C.: U.S. Department of Transportation, Federal Highway Administration, Office of Highway Safety. Grant nr FHWA-RT-90-003. 38 p. Via the Internet: <<http://www.fhwa.dot.gov/tfhrc/safety/pubs/90003/90003.pdf>>.
- [USBLM] United States Bureau of Land Management. 1996. Partners against weeds [microform]: final action plan for the Bureau of Land Management. Billings, MT: USBLM. 43 p.
- [USFS] United States Forest Service, Southern Region. 1990. Final environmental impact statement, vegetation management in the Ozark/Ouachita Mountains. Atlanta, GA: USFS. Series management bulletin nr R8. 45. Shipping list nr 90-163-P. 4 v.
- [USFS] United States Forest Service? 1998. Stemming the invasive tide [microform]: forest service strategy for noxious and nonnative invasive plant management. Washington, D.C.: United States Government Printing Office. 31 p.
- [USFS] United States Forest Service. 1988. Managing competing unwanted vegetation. Washington, D.C.: U.S. Government Printing Office. Publication nr 1988-691059/80. 709 p.

### **Canada**

#### **Ontario**

- Monet S. 1992. Review of integrated weed management for Ontario roadsides. Toronto, Ontario, Canada: Ontario Ministry of Transportation. Report nr MAT-92-03. 57 p.

#### **Other**

- Cole HC, Jr, Watschke TL, Hartwig NL, Kuhns LJ, Lyman GT, Wertz EA, Olsen SJ, Prinster MG. 1987. Roadside vegetation research report. Harrisburg, PA: Pennsylvania Department of Transportation. Report nr PA-86-013+85-08. 58 p.
- Cole HC Jr, Hartwig NL, Kuhns LJ, Watschke TL. 1987. Roadside vegetation management manual. Wertz EA, Lyman GT, editors. Harrisburg, PA: Pennsylvania Department of Transportation. Report nr PA-86-018+85-08. 124 p.
- [NRVM] National Roadside Vegetation Management Association, Integrated Roadside Vegetation Management Program Task Force. 1997. How to develop and implement an integrated roadside vegetation management program: a guide for township, city, county, parish, state, turnpike and other roadside authorities. Newark, DE: National Roadside Vegetation Management Association. 40 p.

## **Opinions, Observations & Proposals**

- [Anonymous]. 1997. Integrated strategies for safety and environment. Paris OECD. 96 p.
- [Anonymous]. 1995. County's roadside vegetation management program is a winner [Umatilla County, OR]. Public Works 126(3):58-59.
- [Anonymous]. 1984. More natural roadsides--within limits. Public Works 115(3):62-65.
- [BR] Better Roads. 2000. Alien invasion: how to deal with invasive exotic plants. Better Roads 70(5):25-27.
- [BR]. 1991. Vegetation management: Lane county's great program. Better Roads 61(10):25.
- [BR]. 1988. NRVMA's top vegetation management programs. Better Roads 58(2):24-26.
- [BR]. 1987. Vegetation management: dot's improve vegetation management practices. Better Roads 57(2):40-44.
- [BR]. 1987. Lane county: a combined vegetation program. Better Roads 57(9):52.
- Buffington JL. 1988. Strategies to reduce vegetation control costs. Transportation Research Record, Issue 1189:41-51.
- Burnette V. 1994. Maryland's vegetation management philosophy for the future. Public Works 125(3):34-35.

## APPENDIX H – LITERATURE SEARCH

- [CP] Cahners Publishing. 1989. Spotlight: vegetation control products. *Highway and Heavy Construction* 232(10):68-70.
- [FHA] United States Department of Transportation/Federal Highway Administration. 2000. Beware of invasive species. *Public Roads* (63)5:25-29.
- [FHA]. 1986. Roadside improvements for local roads and streets. Pamphlet. Electronic copy:  
<<http://www.fhwa.dot.gov/tfhrc/safety/pubs/00002/intro.htm>>
- Flynn L, editor. 1994. Caltrans' vegetation program seeks alternatives to chemical use. *Roads and Bridges* 32(2):56-61.
- Foster RE Jr. 1984. Allelopathy and its potential applications in right-of-way management. *Transportation Research Record*. 969:27-31.
- Hartwig L. 1989. The year weeds cast a dark shadow. *Public Works* 120(11):65-66.
- Hartzler RG, Buhler DD. 1996. Weed seeds and the seed bank: implications for weed management. Ames, IA: Cooperative University Extension Service, Iowa State University. Publication nr 54162;2;0. 1 folded sheet.
- Kuennen T. 1990. Mowing alone won't cut it, Texas county discovers. *Roads and Bridges* 28(2): 56 p.
- Moran PM. 1991. Roadside vegetation management: a proposal for the highway division. Salem, OR: Oregon Department of Transportation. 10 p.
- Ritzer J. 1990. The what and why of natural roadsides. *Public Works* 121(3):49-53.
- Scrimsher M. 1992. County proud of its integrated roadside vegetation management program. *Public Works* 123(11):42-44.
- Sherman F. 1995. Roadside vegetation management: herbicides and beyond. *Transportation Builder* 7(4):18-20.
- Stahl R. 1993. The secret in roadside vegetation management. *Public Works* 124(3):69.
- Stidger RW. 2001. More dot's move to integrated vegetation management. *Better Roads* 70(8):38-42.
- Tatman B. 1989. Roadside maintenance the Ohio way. *Public Works* 120(3):56-57.
- Theisen MS. 1996. How to make vegetation stand up under pressure. *Civil Engineering News* 8(4):32-38.
- Varland KL, Schaefer PJ. 1998. Roadside management trends in Minnesota: 1973 to 1997. In: *International Conference on Wildlife Ecology and Transportation*; 1998 Feb 10-12; Ft. Meyers, FL. Florida Department of Transportation; U.S. Department of Transportation; U.S. Forest Service; and Defenders of Wildlife. p 214-228.
- Wheeler S. 1993. A proposed roadside vegetation management program. *Public Works* 124(3):54-55.
- Zeyher A. 2001. Present arms!: roll call of soldiers in the war against advancing roadside weeds. *Roads and Bridges* 39(5):48-51.
- Zeigler AJ, et al. 1986. Guide to management of roadside trees. McLean, VA: Federal Highway Administration. Contract nr FHWA-IP-86-17. 69 p.

### Research Results

- [BR] Better Roads. 1997. Survey results: how dot's control vegetation. *Better Roads* 67(9):19-20.
- Dance KW. 1990. Review of existing vegetation management practices and identification of future research needs. Downsview, Ontario, Canada: Ministry of Transportation, Research and Development Branch. 41 p.
- Edgar R. 2000. Evaluation of infrared treatments for managing roadside vegetation: final report. Salem, OR: Oregon Department of Transportation. Report nr FHWA-OR-RD-01-06, PSC 14549. 154 p.
- [NRC] National Research Council. 1991. Safety rest areas, roadway vegetation, and utility and highway issues 1991. *Transportation research record* nr 1326. Washington, D.C.: Transportation Research Board, National Research Council. unknown p.
- Storey BB, McFalls JA, Godfrey SH. 1996. The use of compost and shredded brush on rights-of-way for erosion control final report. College Station, TX: Texas Transportation Institute, Texas A&M University System. Contract nr FHWA-TX-97-1352-2F. 230 p.
- Ueckert DN, McGinty WA. 1999. Final report on research to identify effective foliar sprays and mechanized spray delivery systems for selective control of mesquite on rights-of-way. San Angelo, TX: Texas Agricultural Experiment Station. Report nr 2953-S, TX-2953-S. Period covered 9509-9908. 76 p.

## APPENDIX H – LITERATURE SEARCH

Wood TM. 2001. Herbicide use in the management of roadside vegetation, western Oregon, 1999-2000: effects on the water quality of nearby streams. Portland, OR: Oregon Department of Transportation. Series title: Water-resources investigations. Report nr 01-4065 4007444727. 27 p.

### Equipment

[Anonymous]. 2001. Roadside vegetation managers keep track with GIS/GPS. *Public Works* 132(1): 56-58.

[Anonymous]. 1996. Weeds zapped with laser accuracy. *Roads and Bridges* 34(5): 50 p.

Blair, DF. 1999. *Arborist equipment: a guide to the tools and equipment of tree maintenance and removal*. 2nd ed. Champaign, IL: International Society of Arboriculture. 300 p.

[BR] Better Roads. 1989. Equipment helps control vegetation. *Better Roads* 59(5):45-48.

Marum E. 2000. GPS helps manage roadside vegetation. *Roads and Bridges* 38(5):36-38.

Marum E. 2000. GPS helps manage roadside vegetation: progressive manager and high-tech equipment team for new approach and quantitative assessment. *Roads and Bridges* 38(5):36-38.

Slaughter DC, Giles DK, Tauzer C. 1999. Precision offset spray system for roadway shoulder weed control. *Journal of Transportation Engineering* 125(4):364-371.

[SM] Simmons-Boardman 1990. Equipment and materials guide number 2: vegetation control. *Railway Track and Structures* 86(2): 3 p.

Smith DB. 1986. Swath deposit and drift evaluations for roadside sprayers. Final report. Mississippi State, MI: Mississippi State University, Mississippi Agricultural and Forestry Experiment Station. In cooperation with the Mississippi State Highway Department, Research and Development Division in cooperation with the Federal Highway Administration. Report nr MSHD-RD-86-086. 17 p.

Stidger RW. 2001. Sprayer designs target herbicide application, cut costs: infrared and other technologies can help locate and control roadside weeds at lower costs. *Better Roads* 71(5): 26-30.

Toussaint C. 1997. Innovative herbicide sprayers for roadsides, slopes and ditches. St. Paul, MN: Minnesota Department of Transportation. Report nr MN/PR-97/08. 28 p.

### Chemicals

Adrian DD...et al. 1994. Accelerated biodegradation of a herbicide applied to the roadside environment using adapted soil microorganisms. Baton Rouge, LA: Louisiana Transportation Research Center. 182 p.

Ahrens WH, editor. 1994. *Herbicide handbook*. 7<sup>th</sup> ed. Lawrence, KS: Weed Science Society of America and Allen Pr. 352 p.

Ahrens WH, editor. 1998. *Herbicide handbook* 7<sup>th</sup> ed. supplement. Lawrence, KS: Weed Science Society of America and Allen Pr.

[BR]. 1999. Herbicide technology offers many choices. *Better Roads* 69(5):29-30.

[Anonymous]. 1991. Use of chemicals to manage roadside vegetation. Part 1. *Public Works* 122(3): 62-65.

[Anonymous]. 1991. Use of chemicals to manage roadside vegetation. Part 2. *Public Works* 122(4): unknown p.

[Anonymous]. 1991. Use of chemicals to manage roadside vegetation. Part 3. *Public Works* 122(5):65-68.

[Anonymous]. 1979. *Sprayer's guide*. 2<sup>nd</sup> ed. Augusta, ME: Maine Department of Transportation. unknown p.

Burnside OC. 1996. The history of 2,4-D and its impact on development of the discipline of weed science in the United States. In: Burnside OC, editor. *Biologic and economic assessment of the benefits from the use of phenoxy herbicides in the United States*. USDA/NAPIAP Report NR 1-PA-96. p 5-15.

Caylor P. 1998. Herbicides help Illinois dot control roadside weeds. *American City and County* 113(3):17-18.

Conard SG, Emmingham WH. 1984. Herbicides for clump and stem treatment of weed trees and shrubs in Oregon and Washington. Corvallis, OR: Forest Research Laboratory, Oregon State University, College of Forestry. Series nr 9. 8 p.

Conard SG. 1984. Herbicides for brush and fern control on forest sites in western Oregon and Washington. Corvallis, OR: Forest Research Laboratory, Oregon State University, College of Forestry. Series nr 8. unknown p.

## APPENDIX H – LITERATURE SEARCH

- Cobb AH, Kirkwood RC, editors. 2002. *Herbicides and their mechanisms of action*. Boca Raton, FL: CRC Pr. 295 p.
- Devine M, Duke SO, Fedtke C. 1993. *Physiology of herbicide action*. Englewood Cliffs, NJ: Prentice Hall. 441 p.
- Doll, JD. 1988. Roadside weeds: a constant challenge. *Public Works* 119(3):78-79.
- Eaton M. 1991. Training modules target U.S. herbicide users. *Roads and Bridges* 29(2):30- 32.
- French CM, Middlebrooks PB Jr. 1990. Highway use of herbicides in Georgia. Final report. Atlanta, GA: Georgia Department of Transportation. Report nr FHWA-GA-90-8702, GDOT RP 8702. 48 p.
- Jones L. 1989. Developing a successful herbicide program. *Public Works* 120(3):74-75.
- Kuennen, T. 1992. Lower roadside costs with spraying program. *Roads and Bridges* 30(2):24-25.
- Wakefield RC, Sawyer CD. 1986. Use of growth retardants and herbicides for management of roadside vegetation. Contribution 2352. Kingston, RI: Rhode Island Agricultural Experiment Station. 62 p.
- Willoughby I, Dewar J. 1995. *The use of herbicides in the forest: field book 8*. London, UK: HM Stationery Office. 318 p.

### Videos

- Ham D. No Date. *Managing trees for public safety video series: an arborist's guide* (videocassette). Clemson, SC: Clemson University Department of Forest Resources.
- Ham D. No Date. *Managing trees for public safety video series: the administrator's responsibility* (videocassette). Clemson, SC: Clemson University Department of Forest Resources.
- [ISA] International Society of Arboriculture. No date. *Tree health management: evaluating trees for hazard* (videocassette). Champaign, IL: International Society of Arboriculture.

### Fire Management

- Chi CT, Horn DA, Reznik RB, Zanders DL, Opferkuch RE, Nyers JM, Pierovich JM,
- Lavdoia LG, McMahon CK, Nelson RM, Johansen RW, Ryan PW. 1979. *Source assessment: prescribed burning, state of the art*. Washington, D.C.: U.S. Environmental Protection Agency, Office of Research and Development. Report nr EPA-600/2-79-019h. 107 p.
- Cluvine S. 1998. [Booklet] *Planning and Conducting Prescribed Burns in Missouri*. Jefferson City, MO: Missouri Department of Conservation. 12 p. Distribution restricted to those conducting or attending burn classes. Available from 660/885-6981 ext. 241.
- Collins SL, Wallace LL, editors. 1990. *Fire in North American tallgrass prairies*. Norman, OK: Univ of Oklahoma Pr. 175 p.
- Fuller M. 1991. *Forest fires: an introduction to wildland fire behavior, management, firefighting, and prevention*. New York, NY: Wiley. 238 p.
- Smith RL. 1986. *Fire in the environment*. In: Smith RL, editor. *Elements of Ecology*, 2nd edition. New York, NY: Harper and Row. p. 177-197.
- Pyne SJ, Andrews PL, Laven RD. 1996. *Fire ecology*. In: *Introduction to wildland fire*. 2nd ed. New York, NY: Wiley. p. 171-176.
- Whelan R. 1995. *Fire – the phenomenon*. In: *The ecology of fire*. New York, NY: Cambridge Univ Pr. p. 8-56.

### Tree Risk Management

- Albers J, Hayes E. 1990. *How to detect, assess and correct hazard trees in recreational areas*. St. Paul, MN: Minnesota Dept of Natural Resources. 64 p.
- Fazio JR, editor. 1989. *How to recognize and prevent hazard trees: Tree City USA bulletin nr 15*. Nebraska City, NE: National Arbor Day Foundation. 8 p.
- [ISA] International Society of Arboriculture. *Recognizing tree hazards* (brochure). Champaign, IL: International Society of Arboriculture
- Lonsdale D. 1999. *Principles of tree hazard assessment and management: DETR, research for amenity trees no. 7*. London, UK: HM Stationery Office. 388 p.
- Matheny N, Clark JR. 1994. *A photographic guide to the evaluation of hazard trees in urban areas*. Champaign, IL: International Society of Arboriculture. 85 p.

## APPENDIX H – LITERATURE SEARCH

- Mattheck C, Breloer H. 1998. The body language of trees: a handbook for failure analysis: DoE, research for amenity trees no. 4. London, UK: HM Stationery Office. 240 p.
- Robbins K. 1986. How to recognize and reduce tree hazards in recreation sites. NA-FR-31. Radnor, PA: USDA Forest Service, Northeastern Area. 28 p.
- Shigo AL. 1986. A New Tree Biology. Durham, NH: Shigo and Trees. 595 p.

### Hazard Tree Websites via the Internet:

1. <<http://willow.ncfes.umn.edu/Hazard/HAZARD.HT>>.
2. How to recognize hazardous defects in trees. Via the Internet: <[http://www.na.fs.fed.us/spfo/pubs/howtos/ht\\_haz/ht\\_haz.htm](http://www.na.fs.fed.us/spfo/pubs/howtos/ht_haz/ht_haz.htm)>.

## Weed & Brush Management

- [AAB] Association of Applied Biologists; Weeds Group; Institute of Chartered Foresters; Recreation Ecology Research Group, contributors. 1984. Weed control and vegetation management in forests and amenity areas; 1984 Jan 4-5; University of Nottingham, England. Wellesbourne, Warwick: Association of Applied Biologists. 420 p.
- Aldrich RJ, Kremer RJ. 1997. Principles in weed management. 2<sup>nd</sup> ed. Ames, IA: Iowa State University. 455 p.
- Andersen RN, compiler. 1991. The north central weed control conference: origin and evolution; dates not listed; Champaign, IL: North Central Weed Science Society. 206 p.
- Anderson WP. 1996. Weed science: principles and applications. 3<sup>rd</sup> ed. Minneapolis, MN: West. 388 p.
- Ashton FM, Monaco TJ, Barrett M. 1991. Weed science: principles and practices. 3<sup>rd</sup> ed. New York, NY: Wiley. 466 p.
- Bovey RW. 2001. Woody plants and woody plant management: ecology, safety, and environmental impact. New York, NY: Marcel Dekker Pr. 564 p.
- Cousens R, Mortimer M. 1995. Dynamics of weed populations. New York, NY: Cambridge University Pr. 332 p.
- Davies RJ. 1987. Trees and weeds: fc handbook 2. London, UK: HM Stationery Office. 36pp
- Gold MV. 1994. Cultural and mechanical weed control. 1994. Beltsville, MD: National Agricultural Library. 63 p.
- Harper-Lore BL, Wilson M, editors. 2000. Roadside use of native plants. Washington, D.C.: Island Pr. 665 p. Via the Internet: <<http://www.fhwa.dot.gov/environment/rdsduse/index.htm>>.
- Harrington TB, Parendes LA, editors. 1993. Forest vegetation management without herbicides: Proceedings of a workshop; February 18-19, 1992; Oregon State University, Corvallis. Corvallis, OR: Forest Research Laboratory. 129 p.
- Kozlowski TT, Pallardy SG. 1997. Growth control of woody plants. San Diego, CA: Academic Press. 672 p.
- Lawrence T, Norquay P, Liffman K. 1993. Practical tree management: an arborist's handbook. Melbourne, Australia: Inkata Press. 122 p.
- Radosevich SR, Hold J, Ghera C. 1997. Weed ecology: implications for management. 2<sup>nd</sup> ed. New York, NY: J. Wiley. 589 p.
- Rice RP Jr. 1992. Nursery and landscape weed control manual. 2<sup>nd</sup> ed. Fresno, CA: Thomson Pr. 290 p.
- Ross MA, Lembi CA. 1999. Applied weed science. 2<sup>nd</sup> ed. Upper Saddle River, NJ: Prentice Hall. 452 p.
- Scifres CJ. 1980. Brush management. College Station, TX: Texas A&M Univ. Pr. 360 p.
- Smith, AE, editor. 1995. Handbook of weed management systems. New York, NY: Marcel Dekker Pr. 741 p.
- Tu M, Hurd C, Randall JM. April 2001. Weed control methods handbook. In: The Nature Conservancy: invasives on the web. Davis, CA: The Nature Conservancy Wildland Invasives Species Team: University of California. Via the Internet: <<http://tncweeds.ucdavis.edu/handbook.html>>.
- Wakefield RC, Sawyer CD. 1982. Roadside vegetation management. Kingston, RI: Rhode Island Agricultural Experiment Station. Bulletin 432. 28 p.
- Walstad JD, Kuch PJ. 1987. Forest vegetation management for conifer production. New York, NY: Wiley. 523 p.

## APPENDIX H – LITERATURE SEARCH

Weed control manual and herbicide guide. 1991- present (serial). Willoughby, OH: Meister Publishing.

Zimdahl RL. 1999. Fundamentals of weed science. 2<sup>nd</sup> ed. San Diego, CA: Academic Pr. 556 p.

### **Training Manuals**

Fawcett RS. 1987. Agricultural weed control, category 1A: a guide for commercial pesticide applicators. Ames, IA: Cooperative University Extension Service, Iowa State University. 43 p.

### **Tree Pruning**

[ANSI] American National Standards Institute. 2001. American national standard for arboricultural operations-pruning, trimming, repairing, maintaining, and removing trees and cutting brush-safety requirements (ANSI Z133.1). Champaign, IL: International Society of Arboriculture. 32 p

[ANSI] American National Standards Institute. 2001. American national standard for tree care operations-tree, shrub, and other woody plant maintenance-standard practices (pruning) (ANSI A300 (Part I)). Manchester, NH: National Arborist Association. 9 p.

Bedker PJ, O'Brien JG, Mielke ME. 1995. How to Prune Trees. NA-FR-01-95. Radnor, PA: USDA Forest Service, Northeastern Area State and Private Forestry. 30 p. Via the Internet: <<http://willow.ncfes.umn.edu>>.

Britton J, Harris R. 1994. Tree-pruning guidelines. Champaign, IL: International Society of Arboriculture. 14 p. (Accompanies ANSI A300 Pruning Standard)

Brown GE. 1995. The pruning of trees, shrubs and conifers. Portland, OR: Timber Press. 374 p.

Gilman EF. 1997. Trees in urban and suburban landscapes: an illustrated guide to pruning. Albany, NY: Delmar Publishers. 560 p.

[ISA] International Society of Arboriculture. 1995. Tree-pruning guidelines. Champaign, IL: International Society of Arboriculture. 14 p.

### **Pruning around overhead electric lines.**

Ham DL. No date. Trees and overhead electric wires: proper pruning and selection. Champaign, IL: International Society of Arboriculture. 10 p.

[ISA] International Society of Arboriculture. Avoiding tree and utility conflicts (brochure). Champaign, IL: International Society of Arboriculture.

Matheny NP, Clark JR. 1993. A handbook of hazard tree evaluation for utility arborists. Champaign, IL: International Society of Arboriculture. 34 p.

Matheny NP, Clark JR. 1994. A photographic guide to the evaluation of hazard trees in urban areas. 2nd ed. Champaign, IL: International Society of Arboriculture. 85 p

Shigo AL. 1990. Pruning trees near electric utility lines. Durham, NH: Shigo and Trees. 34 p.

### **Chain Saw Safety**

[ISA] International Society of Arboriculture. No date. ArborMaster Training video series III: chainsaw safety, maintenance, and cutting techniques (six videocassettes and handbooks). Champaign, IL: International Society of Arboriculture.

### **Tree Climbing**

Lilly S. 1998. Tree climber's guide. Hagerstown, IN: Exponent Publishers. 143 p.

[ISA] International Society of Arboriculture and National Arborist Association. 1999. Basic training for tree climbers (five videocassettes and handbook). Champaign, IL: International Society of Arboriculture.

[ISA] International Society of Arboriculture. No date. ArborMaster Training video series I: climbing techniques (six videocassettes and handbooks). Champaign, IL: International Society of Arboriculture.

### **Insects & Disease**

Anonymous. 1979. A guide to common insects and diseases of forest trees in the northeastern United States. Broomall, PA: USDA Forest Service, Northeastern Area, State and Private Forestry. Grant nr: NA-FR-4. 127 p.

Butlin H. 1995. Tree diseases and disorders. New York, NY: Oxford University Pr. 460 p.

## APPENDIX H – LITERATURE SEARCH

- Hepting GH. 1971. Diseases of forest and shade trees of the United States. Washington, D.C.: U.S.D.A. Forest Service, Agricultural Handbook No. 386. 658 pp.
- Hiratsuka, Y. 1987. Forest tree diseases of the prairie provinces. Inform. report nr: NOR-X-286. Edmonton, Canada: Northern Forestry Centre, Canadian Forestry Service. 142 p.
- [ISA] International Society of Arboriculture. Insect and disease problems (brochure). Champaign, IL: International Society of Arboriculture.
- Johnson WT, Lyon HH. 1991. Insects that feed on trees and shrubs. Ithaca, NY: Comstock Publishing Associates, Cornell University Press. 560 p.
- Sinclair WA, Lyon HH, Johnson WT. 1987. Diseases of trees and shrubs. Ithaca, NY: Comstock Publishing Associates, Cornell University Press. 575 p.
- Tattar T. 1989. Diseases of shade trees. Revised ed. San Diego, CA: Academic Press. 361 p.

### **Railroads**

- [Anonymous]. 1990. Controlling vegetation. *Railway Track and Structures* 86(2):27 p.
- [Anonymous]. 1989. The basics of vegetation control. *Railway Track and Structures* 85(3): 3 p.
- Higgins T. 2001. Uprooting weed-control obstacles: railroads, contractors encounter weather, regulatory challenges when managing vegetation growth. *Progressive Railroading* 44(4):1-4.
- Holt HA, Breedlove DA. 1990. Line-of-road herbicide tests: a review of the latest results. *Railway Track and Structures* 86(2):28-29.
- Holt, HA, McKenzie, RL, Dirks, RD. 1999. Weed problems yield to innovations. *Railway Track and Structures* 95(1):28-30.
- Holt HA, McKenzie RL, Dirks RD. 1998. Innovations in railroad vegetation management. In: 1998 [AREMA] American Railway Engineering and Maintenance-of-Way Association Track and Structures Conference; 1998 Sept. 14-16; Chicago, IL. Landover, MD: AREMA. 8 p.
- Holt HA, Breedlove DA, Caldanaro RA. 1989. Vegetation control. *Railway Track and Structures* 85(3):23-27.
- Kube K. 2000. Brushing up on weed control. *Progressive Railroading* 43(6):66-70.
- Matoba K. 2001. The abc's of vegetation control. *Railway Track and Structures* 97(1):22-23.
- Wujcik M. 1987. Clearing the track: vegetation control is one of the most important aspects of trackside maintenance. *Progressive Railroading* 30(6):56-58.

## GLOSSARY

§ The symbol 'section.' It is used to designate sections of legal code numbers. For example: Iowa Code §314.22 = Iowa Code section 314.22.

AASHTO (or AASHO). American Association of State Highway and Transportation Officials.

Absorption (of herbicides). The movement of herbicides across the surface barriers to the inner leaf tissues.

Active Ingredient. The chemical compound in a formulated product that is responsible for herbicidal activity.

Adsorption. The concentration of material at the contact zone of two substances.

Aerosol (Herbicide). Fine spray produced by pressurized gas that leaves very small droplets of herbicide in air.

Allelopathy. The suppression of growth of one plant species by another due to the release of toxic substances.

Allergenic. Causing allergic sensitization.

ANSI. American National Standards Institute.

Applicator. See Licensed Applicator.

Auxin. An organic compound and important plant hormone, active at low concentrations, which promotes plant growth by cell enlargement.

Back Fire. Fire intentionally ignited to remove combustible materials in the path of advancing flames; burns into (not with) the wind.

Backslope. The sloping surface of a cut, borrow pit, or ditch of which the downward inclination is toward the traveled way.

Basal Bark Treatment. The practice of applying herbicide to the base of a tree that will absorb through the bark.

Blanket Spraying. A foliar application of an herbicide that covers a broad area regardless of the quality or composition of vegetation growing there. In Iowa, blanket spraying of herbicides along roadsides has weakened, reduced, or eliminated many native prairie species while simultaneously promoting weeds.

BMP. Best management practice.

## Glossary

- Brush .** A growth of shrubs or small trees usually of a type undesirable to livestock or timber management, but which are sometimes useful or can be managed for wildlife.
- Brush Control.** Any practice employed to reduce the influence of brush in the management or use of the land.
- Brush Management.** Management and manipulation of stands of brush to achieve specific management objectives.
- Calibrate.** To determine, check, or rectify the delivery per unit area of herbicides, fertilizers, seeds, or such from machinery used for their application.
- Cambium.** The layer of delicate tissue, responsible for all radial trunk growth, between the inner bark (phloem) and the wood (xylem) of stems and branches of woody plants.
- Canopy.** Collectively, the foliage and stems excluding the main trunk, of trees. Canopy cover is the ground area covered by the canopy.
- Carcinogen.** A substance or agent which produces or incites cancerous growth.
- Carrier.** Any material, liquid or solid, used to dilute and facilitate the dispensing of herbicides.
- Clear Roadside Policy.** The policy employed by a highway authority to increase safety, improve traffic operation, and enhance the appearance of highways by designing, constructing, and maintaining highway roadsides as wide, flat, and rounded, as practical and as free as practical from physical obstructions above the ground such as trees, drainage structures, massive sign supports, utility poles, and other ground-mounted obstructions.
- Clear Roadway Width.** The horizontal distance from face of curb to face of curb, or face of guardrail to face of guardrail, whichever is less.
- Clear Run-Out Area.** The area at the toe of a nonrecoverable slope available for safe use by an errant vehicle.
- Clear Zone.** An obstruction-free vehicle recovery area adjacent to the road traveled lane. A clear zone may consist of: 1) a shoulder, foreslope, ditch bottom, and backslope; 2) a shoulder, recoverable slope, non-recoverable slope, and/or clear run-out area. The desired width is dependent upon the traffic volume and speeds, and on the roadside geometry.
- Climate.** The average weather conditions of a place over a period of years.
- Contact Herbicide.** A herbicide that kills only the plant tissue with which it comes in contact, as contrasted to translocated herbicides.

## Glossary

County Board of Supervisors (or Board of Supervisors). The County Board of Supervisors as constituted under Chapters 39 and 331, Code of Iowa.

County Conservation Board (or CCB). The County Conservation Board as constituted under Chapter 350, Code of Iowa.

County Conservation Board Director (or CCB Director). The County Conservation Board Director as constituted under Chapter 350.4, Subsection 6, Code of Iowa.

County Engineer. A registered professional engineer appointed by the board of supervisors as constituted under Chapter 309.17, Code of Iowa.

CPR. Cardiopulmonary Resuscitation

Critical Slope. A slope on which a vehicle is likely to overturn. Slopes steeper than 3H:1V are considered critical slopes.

Crown. The enlarged base of a woody stem, mostly under the surface of the soil immediately above the roots, supporting many buds which replace the top growth of the woody plant following disturbance.

Cut Stump Treatment. The practice of applying herbicide over the cambium tissue exposed on a cut surface of a tree or limb stump.

Cuticle. The relatively thin wax-like covering of the epidermis of plants, usually in reference to leaves.

DBH. Diameter of a tree trunk at breast height.

Decreaser. Plant species of the original or climax vegetation that will decrease in relative amount with continued overuse.

Diluent. Any material, liquid or solid, used to dilute active ingredients in the formulation or in the field application of herbicides.

Divided Highway. A highway with separate roadways for traffic in opposite directions.

DNR. Department of Natural Resources.

DOT. Department of Transportation.

Drift. 1. The movement from the point of origin or displacement of materials, especially the lateral displacement of herbicide sprays, causing movement away from the target area.  
2. Movement of materials by wind or water.

## Glossary

**Drop (Droplet).** A small amount of liquid produced more or less in a spherical mass; collectively, drops form the spray sheet.

**Drop Spectrum.** The array of drop characteristics, usually in reference to size, in a spray; the proportions of sizes of drops in the spray.

**Easement.** A nonpossessing interest held by one person or company in the land of another whereby the first person is accorded partial use of such land for a specific purpose.

**Emulsifier.** Any material which facilitates formation of emulsions.

**Emulsion.** The suspension of one liquid in another, such as oil in water, forming a liquid preparation with the color and consistency of milk. (An invert emulsion is the reverse situation of the standard emulsion, the suspension of water in oil, forming a preparation with the consistency of mayonnaise).

**Encroachment.** Parallel installation within highway right-of-way (longitudinal) that may include crossings of the roadway template.

**EPA Establishment Number.** The number given by Environmental Protection Agency that identifies the factory that produced an herbicide.

**EPA Registration Number.** The number given by Environmental Protection Agency when a herbicide label has been approved.

**Epinasty.** The curving and bending of plant parts due to increased growth on the upper surface of the plant part. Typical reaction of susceptible plants to hormone-type herbicides.

**FHWA.** Federal Highway Administration.

**Firebreak.** A natural or man-made barrier used to prevent or retard the spread of fire and in existence before the fire occurs.

**Flagging.** The result of incomplete defoliation of trees or partial foliage replacement following spraying, with a small percentage of individual branches retaining a proportion of their foliage.

**Foliage.** Collectively, the leaves of plants, usually those green or live; mass of leaves, leafage.

**Foliar Spray.** Herbicide applied in liquid form as a fine spray to the leaves of a plant.

**Forb.** Any herbaceous plant other than grasses, sedges or rushes.

## Glossary

**Foreslope.** The sloping surface of an embankment, ditch, or borrow pit of which the downward inclination is away from the traveled way.

**Formulate.**

1. A herbicidal preparation supplied by a manufacturer for practical use.
2. The process, carried out by manufacturers, of preparing herbicides for practical use.

**General Use Pesticide (or GUP).** A product that is available for purchase and use by the general public. This designation assigned to a pesticide product because it will not ordinarily cause unreasonable adverse effects on the user or on the environment when used in accordance with their label instructions.

**GIS.** Global Indexing System.

**Granular.** A formulation of herbicide in dry discrete particles of generally less than 10 mm<sup>3</sup>.

**Growth Regulator.** Chemicals which alter the rate and/or extent of growth used primarily for control of unwanted vegetation, although extremely low concentrations of these compounds, especially auxin-like chemicals, may promote growth.

**Grubbing.** The physical act of removing almost entire plants by excavating and uprooting.

**Habitat.** The natural abode of a plant or animal, including all biotic, climactic, and soil conditions or other environmental influences affecting life.

**Hazard.** A side slope, a fixed object, or water that, when struck, would result in unacceptable impact forces on the vehicle occupants or place the occupants in a hazardous position. It can be either natural or manmade.

**Head Fire.** Fire burning with the wind.

**Heartwood.** The hard central wood of the trunk of a tree.

**Herbaceous Plant.** A vascular plant that does not develop persistent woody tissue above ground.

**Herbicide.** Any chemical which is toxic to plants (phytotoxic); a specific group of pesticides.

**Humus.** The well-decomposed, more or less stable part of the organic matter of the soil.

**IA DOT.** Iowa Department of Transportation.

**Increaser.** Plant species of the original vegetation that increase in relative amount, at least for a time, with overuse.

## Glossary

**Infiltration.** The process by which water enters the soil through the surface.

**Inflorescence.** The flowering part of plants; the structure supporting the flowers.

**Inslope.** That portion of the roadway embankment between the edge of the pavement and the bottom of the drainage ditch or its intersection with natural ground.

**Invader.** Plant species that were absent or present in only very small amounts in undisturbed portions of the original vegetation of a specific range site and will invade following disturbance or continued overuse.

**Invasion.** The migration of organisms from one area to another and their establishment in the latter.

**Invert Emulsion.** The suspension of water droplets in a continuous oil phase.

**IRVM.** Integrated Roadside Vegetation Management. A native plant conservation strategy employed by the IA DOT and many Iowa counties in an effort to preserve, plant, and maintain native vegetation in roadside ditches as constituted under Chapters 312 and 314, Code of Iowa.

**ISAC.** Iowa State Association of Counties.

**Kick Back.** A strong thrust of a chain saw back toward the faller generally resulting from improper use of the nose of the bar or the pinching of the bar in a cut. Kickback causes loss of control of the saw. Kick-back also refers to a tree jumping back over the stump toward the faller.

**Lateral Fire.** A fire burning at a right angle to the wind.

**Leaching.** The removal of materials in solution; in the case of herbicides, resulting in downward movement through the profile.

**Leg Protector.** Ballistic nylon pad attached to one or both pant legs to protect the leg from contact with the saw chain. It can be attached to either the inside or outside of the pant leg.

**Licensed Applicator.** Applicators applying herbicides on Iowa rights-of-way must pass certification exams, administered by the Iowa Department of Agriculture and Land Stewardship, to become certified pesticide applicators. These exams cover the information contained in the Iowa Core Manual (Pesticide Applicators Guide) and the Category 6 (Right-of-Way) Manual.

## Glossary

**Living Roadway Trust Fund (or LRTF).** Living Roadway Trust Fund as constituted under Chapter 314, Code of Iowa.

**Lodged Tree (Hung Tree).** A tree leaning against another tree or object which prevents it from falling to the ground.

**Mesic.** An environment having a balanced supply of moisture.

**Mixed Brush.** A brush community composed of two or more species of woody plants which often differ significantly in growth habit and/or form.

**Mulch.** A layer of dead plant material on the soil surface.

**Necrosis.** Localized death of living tissue.

**Nonrecoverable Slope.** A slope on which an errant vehicle will continue until it reaches the bottom, without having the ability to recover control.

**Normal.** Crossing at a right angle.

**Obstacle.** Fixed object in a clear zone that would be hazardous to an errant vehicle.

**Oiling.** The practice of applying diesel oil, kerosene, motor oil, or similar hydrocarbons to the base of trees.

**OSHA.** Occupational Safety and Health Administration.

**Overstory.** The uppermost layer of plants, usually trees, shrubs and/or vines.

**Pathogen.** Any disease-producing organism.

**Pavement.** That portion of a roadway used for the movement of vehicles, exclusive of shoulders.

**Recoverable Slope.** A slope on which a the driver of an errant vehicle can regain control of the vehicle.

**Pellet.** A dry formulation of herbicide and other components in particles usually larger than 10 mm<sup>3</sup>.

**Perennial.** A woody or herbaceous plant living from year to year, not dying after once flowering.

**pH.** Negative logarithm of the hydrogen ion concentration. A notation to designate or indicate degree of acidity or alkalinity. Indicates soil reaction.

## Glossary

**Phloem.** The food-conducting system of plants; transports substances manufactured in the leaves to the stems and roots.

**Phytotoxic.** Injurious or toxic to plants.

**Plant Control.** The reduction, sometimes complete, of the influence of undesirable plants on any given area or habitat.

**Plant Kill.** An index, usually expressed as a percentage, of the population of plants dead as the result of any control effort.

**PPE.** Personal Protective Equipment.

**Prescribed Burning.** The use of fire as a management tool under specified conditions for burning a predetermined area.

**Rate.** The amount of herbicide equivalent, usually expressed as pounds per acre, applied per unit area.

**Regrowth.** Plant growth originating from original stems, branches, and/or roots after the original plant growth has been physically removed or killed and left in place.

**Residue.** Detectable herbicide residing some time after the application process.

**Restricted Exposure Interval (or REI).** The time immediately after a pesticide application when entry into a treated area is limited. During an REI, do not allow workers to enter a treated area or contact anything treated with the pesticide to which the REI applies. REIs are located on the pesticide label. When two (or more) pesticides are applied at the same time and have different REIs, you must follow the longer interval.

**Restricted Use Pesticide (or RUP).** A product that is available for purchase and use only by certified pesticide applicators or persons under their direct supervision. This EPA designation is assigned to a pesticide product because of its relatively high degree of potential human and/or environmental hazard even when used according to label directions.

**Right-of-Way (or ROW).** All of the land, including the entire area between the property lines, acquired by the Department for road purposes whether or not a highway has been constructed thereon.

**Road.** A general term denoting a public way for vehicular travel, including the entire area within the right-of-way.

**Roadbed.** The area of the roadway between the tops of foreslopes.

## Glossary

**Roadside Biologist.** A job title change from Roadside Manager if a 4 year college science degree is considered necessary for the position.

**Roadside Manager.** A county employee responsible for an IRVM program along county roadsides. The position is created and funded by a County Board of Supervisors, and usually supervised by the County Engineer, CCB Director, or is an independent position under the authority of the County Board. Engineers or CCB Directors that have expressed satisfaction with their Roadside Managers have described a situation where good communication exists between the County Engineer and CCB Director and that the program is adequately funded.

**Roadside.** The area within the right-of-way and outside the shoulder lines of a roadbed.

**Roadway.** That portion of a highway, including shoulders and auxiliary lanes, available for vehicular use. A divided highway has two or more roadways.

**RTU (or Ready-to-Use).** A formulation that is very low in concentration, used without dilution or mixing, usually a liquid, frequently applied via a trigger sprayer bottle, as in Tordon RTU.

**Sapwood.** The softer part of the wood between the inner bark and the heartwood.

**Section.** The symbol ‘§’ in the Iowa Code, meaning section. Example: §314.22 reads: Section 314.22.

**Shoulder.** That portion of the roadbed contiguous with the traveled way for accommodation of stopped vehicles, for emergency use, and for lateral support of base and surface courses.

**Shrub.** A plant that has persistent, woody stems and a relatively low growth habit and that generally produces several basal shoots instead of a single bole.

**Sight Distance.** The length of roadway ahead visible to the driver. The minimum sight distance available on a roadway should be sufficiently long to enable a vehicle traveling at or near the design speed to stop before reaching a stationary object in its path. Although greater length is desirable, sight distance at every point along the highway should be at least that required for a below-average operator or vehicle to stop in this distance.

**Site.** The place or seat of any specified thing.

**Slope.** The inclination of a line or surface expressed as a ratio of horizontal distance to vertical distance.

**Soil Application.** Applied primarily to the soil surface rather than to vegetation.

## Glossary

**Spot Spraying.** Careful application of an herbicide only to target vegetation avoiding the surrounding area.

**Spray Drift.** Movement of airborne spray from the intended area of application.

**Spray Pattern.** The density, distribution of sizes, and general outline of contact of a spray on any environmental surface.

**Structures.** Bridges, culverts, catch basins, drop inlets, retaining walls, cribbing, utility accesses, end walls, buildings, sewers, service pipes, underdrains, foundation drains, and other features which may be encountered in the work and not otherwise classed herein.

**Sucker Sprouting.** Regrowth of buds and stems from a cut stump.

**Surfactant.** Surface active agents; materials which facilitate spreading and wetting of sprayed surfaces and which may also aid in emulsifying or dispensing herbicides.

**Susceptibility.** Lack of tolerance for treatment, as with herbicides.

**Suspension.** Finely divided solid particle dispersed in a solid, liquid or a gas.

**Swath.** The width of area treated in one pass, as when brush is aurally sprayed.

**Synergism.** Complementary effects of two or more different chemicals resulting in an effect that would be greater than that expected from the sum of the effects of the chemicals applied independently.

**Systemic Herbicide.** An herbicide that once absorbed is translocated within a plant. Systemic herbicides have the potential to kill a portion of the root system so that sprouting is reduced or eliminated.

**Toe of Foreslope or Backslope.** The intersection of the fore- or backslope and the natural ground or ditch bottom.

**Traffic Barrier.** A longitudinal barrier, including bridge rail or an impact attenuator, used to redirect vehicles from hazards located within an established Design Clear Zone, to prevent median crossovers, to prevent errant vehicles from going over the side of a bridge structure, or (occasionally), to protect workers, pedestrians, or bicyclists.

**Traffic Control Zone.** The distance between the first advance warning sign and the point beyond the work area where traffic is no longer affected. This does not include work more than 12 feet from the outside edge of the traveled way.

## Glossary

**Traveled Way.** The portion of the roadway intended for the movement of vehicles, exclusive of shoulders and lanes for parking, turning, and storage for turning.

**Translocation.** The movement of materials from one place to another, especially the movement of herbicides within plant systems.

**Tripartite Nutrition.** The sharing of nutrients between the linked root systems of three plants. It usually involves the roots of two host plants and a specialized connecting fungus. Among trees, tripartite nutrition is common among oaks and walnuts. Two trees linked in such a feeding arrangement are susceptible to damage by the application of a systemic herbicide to just one tree.

**Understory.** Plants growing beneath the canopy of another plant. Usually refers to grasses, forbs, and low shrubs under a tree or brush canopy.

**Utility.** All privately, publicly or cooperatively owned lines, facilities and systems for producing, transmitting or distributing communications, power, electricity, light, heat, gas, chemicals, oil, crude products, water, steam, waste, storm water not connected with highway drainage, and other similar commodities, including publicly owned fire and police signal systems and street lighting systems, which directly or indirectly serve the public or any part thereof.

**Vegetative Reproduction.** Production of new plants or plant parts by asexual methods such as from buds on roots and stems.

**Volatility.** The ability of a liquid to change to a gas, such as the vaporization of herbicides under high temperatures.

**Weed Commissioner.** The County Weed Commissioner as constituted under Chapter 317.3, Code of Iowa.

**Wettable Powder.** A finely divided dry herbicide formulation that can be suspended readily in water.

**Xylem.** The plant cells which transport water and minerals in plants and collectively form the woody plant tissues of plants.

## References

- Bellinger RG, coordinator. 2002. Pesticide information program. Clemson, SC: Department of Entomology, Clemson University. Via the Internet: <http://entweb.clemson.edu/pesticid/index.htm#up>. Accessed 2002 May 15.
- Schulze LD, coordinator. 2002. Pest management approaches for the master gardener. Lincoln, NE: Cooperative Extension, Univ. of Nebraska. Via the Internet: <http://pested.unl.edu/masgrd97.htm>. Accessed 2002 May 21.
- Scifres CJ. 1980. Brush management. College Station, TX: Texas A&M Univ. Pr. 360 p.
- Snyder, Chris. 2001. IRVM main page. In: Welcome to Mahaska County. Oskaloosa, IA:

## Glossary

Quick Arrow Solutions. Via the Internet:

<[http://www.mahaskacounty.org/departments/irvm/irvm\\_main.html](http://www.mahaskacounty.org/departments/irvm/irvm_main.html)>. Accessed 2002 May 21.

[WS DOT] Washington State Department of Transportation. 2001. Roadside Safety Elements.

In: Design Manual. Olympia, WA: WSDOT. Publication nr M22-01. p. 700-1 to 16. Via the Internet:

<<http://www.wsdot.wa.gov/fasc/engineeringpublications/desEnglish/700-E.pdf>>. Accessed 2002 May 15.

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